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January 20, 1923

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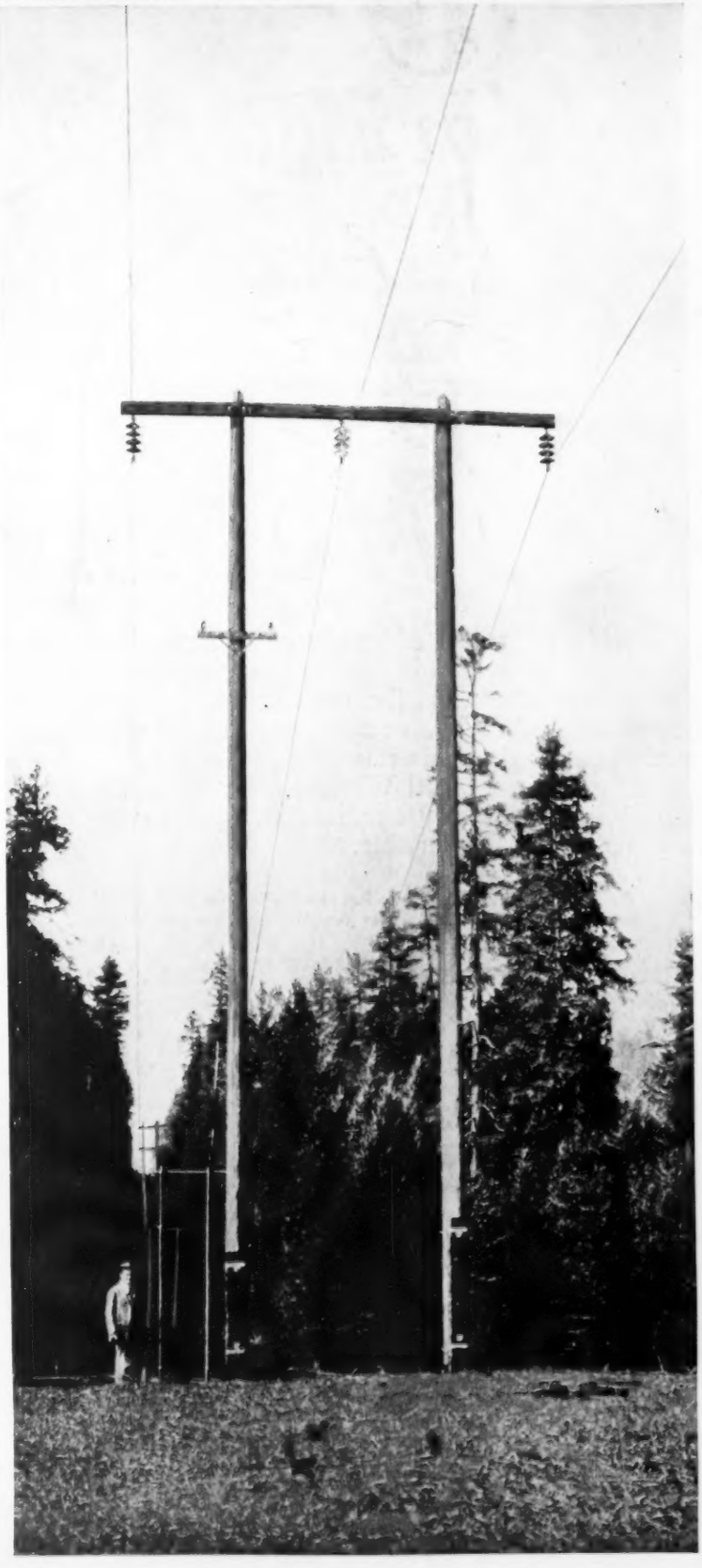

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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 81 New York, Saturday, January 20, 1923 Number 3

Stop the Negative Guesswork

WEST of the Rockies a new drive is on to extend and intensify the use of electrical appliances in the home. There are a million and a half electrically connected residences in that region. Already certain central-station companies—notably the California Oregon Power Company, the Idaho Power Company and the Washington Water Power Company—have succeeded in introducing electric ranges and water heaters to the extent of one to every five of their residential consumers. The forward movement, which looks to building up electrical household appliance loads to the same degree of saturation in every district, is worthy of the electrical industry, and it should receive similar impetus in every nook and corner of the country.

But there is one great obstacle. As a prominent manufacturer recently expressed it in a line: "Our most difficult and persistent enemies are the electrical men themselves."

An "old fogy," according to William James, is a man who has ceased to accept new thoughts, and he confessed having known some men who showed symptoms of old-fogyism at the age of twenty-five. The question is important, because the disease is a prevalent one and the old fogy is a menace to any industry in which he engages. He is the man who ties his industry down to inefficient methods and hampering limitations.

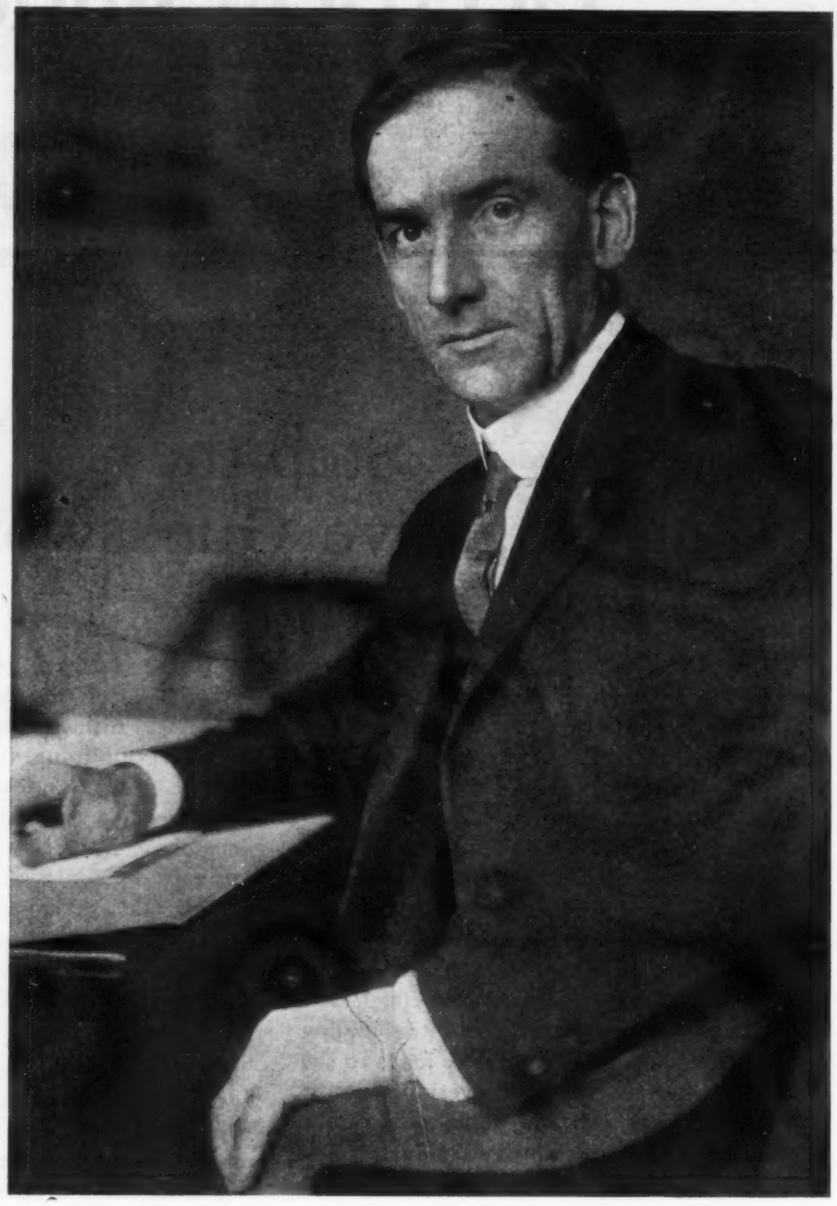
In the electrical field he is not sufficiently convinced of the value of electricity for cooking, dishwashing, water heating and refrigerating to use it for these purposes himself. He will doubtless put up a very good sales argument if confronted with a prospective customer, but he will tell his friends, as his private opinion, that, aside from electric flat-irons and perhaps vacuum cleaners and possibly clothes washers, there is not one electric appliance which has really proved itself.

This man, and he is surprisingly common in the ranks of the electrical industry, is the greatest hindrance to the advancement of the electrical idea today. It is a common statement among electrical men that they must "sell themselves" before they sell the public. But apparently most of them mean by this that they must somehow acquire an inpouring of enthusiasm on things electrical which will descend from heaven in the form of religious inspiration.

This skepticism and apathy are a tremendous handicap under which our pioneers must struggle. The public naturally considers all members of the electrical industry experts in this field and takes their word, especially if it be derogatory, as final. The man who by snap judgment condemns any new device or method therefore does a tremendous injustice and he is hampering his own work.

Frederick Gardner Cottrell

A notable contributor to electrochemical progress through the development of the electrical precipitation process.



ONE of the leaders in the field of electrochemical research is F. G. Cottrell, research chemist and chairman of the division of chemistry and chemical technology of the National Research Council. The Cottrell process which bears his name and by which he is best known is a simple electrical process by which foreign substances in an admixture with gases or liquid are deflected when made to pass through an electrical field and caused to be deposited in chambers especially prepared for that purpose. So simple is the system that it has usually paid for itself within the first few months of operation by the value of the by-products saved, and so important is it that it may be said to have saved more than one smelting and cement industry from being put out of business as a public nuisance.

Mr. Cottrell is a native of California and a graduate of the University of California, class of 1896. Following graduation, for three years he served as a teacher of chemistry in the Oakland High School. He then went to Europe for further study, receiving a degree from the University of Berlin in 1901 and a Ph.D. from the University of Leipzig in 1902. On his return to California in the latter year he became associated with the chemical department of his Alma Mater, rising to the rank of assistant professor in 1906. About this time he conducted numerous experiments in electrical precipitation on the principles laid down by Walker and Lodge. He was more successful than they in establishing the commercial feasibility of the system, and as early as 1906 an installation was made at the Hercules works of the E. I. du Pont de Nemours Powder Company at Pinole, Cal. Since that time the principle has been applied to the removal of fumes from smelter stacks, the recovery of potash from cement plants, the dehydration of oil and numerous other processes.

In 1911 Mr. Cottrell's services were asked for by the Bureau of Mines and he became consulting chemist with that organization, rising to be director of the bureau in 1920. His interest has always, however, lain primarily with research, and in 1921 he resigned to accept his present post with the National Research Council.

Mr. Cottrell is deeply interested in public service in the broadest sense of the word. Typical of the man is his action, while still dependent on the modest income of an assistant professor, in transferring to the Smithsonian Institution substantially all his rights to his inventions and patents in the field of electrical precipitation, in order that the profits might be applied to the advancement of scientific research.

Editorial Comment

Electrical World, January 20, 1923

Volume 81 Number 3

Do Our Associations Function?

THIS question has often been asked by those who contribute as well as by those who have been asked to contribute to the support of the various societies of the electrical industry. Needless to say, organizations which measure up to expectations seldom have to worry greatly about the wherewithal to "carry on." Nevertheless none is ever immune from the necessity of hustling for funds. Though they be as chaste as ice and as pure as snow, they shall not escape calumny, and though the benefits they confer on those who support them be as manifest as the nasal organ of a Roman senator, yet for one who gladly proffers his assistance there are three who wait to be coaxed or who demand superfluous proof.

In the case of the National Electric Light Association at least this necessary work of supererogation has been done well enough to convince even him "who complies against his will." President Frank W. Smith has prepared a report reviewing the affairs of that organization for the first half of the year. In reading his narrative no one can help being impressed with the tremendous scope of the work in which the association is engaged. Mr. Smith and his staff are to be congratulated on such an excellent account of their stewardship. It should silence the carpers and cynics as well as the honestly doubting Thomases, if such there be, and will deprive the reluctant contributor even of the chance to pose as a benefactor, so clearly is he shown to be an investor for his private good as well as for the good of the industry on which he depends.

Notable Achievement in Radio Telephony

THE speeches delivered in New York last Sunday night and transmitted by radio telephone to New Southgate, England, unquestionably establish a record of development noteworthy in the art. As long ago as 1915 successful radio telephony had been carried on between the naval radio station at Arlington and such distant points as San Francisco, Honolulu and Paris; but these were mere demonstrations indicating the practicability of wireless speech over long distance as soon as improvements in transmitting and receiving apparatus, particularly the former, could be brought about. With the development of continuous-oscillation systems, detectors and amplifiers, and more especially water-cooled vacuum tubes, long-distance radio telephony became a commercial possibility. Although still imperfect, it is nearer perfection than either the telegraph or the telephone was twenty years after its introduction. Ever since Marconi's first experiment scientific interest all over the world has been aroused in radio communication, and that interest has continued unabated until this day.

Meanwhile the aspect of mystery which covers the working of radio grips the mind of the general public, and countless persons, not understanding the physics of what they are attempting, nevertheless, thanks to a great variety of commercial apparatus, have been able to gratify a passion for wireless experimentation. Amateur interest was increased a thousandfold when broadcasting stations were established in every section of the country. It is interesting to observe that telegraphy and telephony, wired or wireless, are not competitors, but co-operators. Each has its particular field and function, and it is particularly gratifying to note the vigorous development of radio despite the limitations imposed on it. It is a matter for congratulation that the art has reached such a point that transatlantic radio telephony is now virtually assured.

An Engineer Ambassador

WITH a sincerity and an unassuming convincingness that captured his audience, Prince Caetani, the recently appointed Ambassador from "the new Italy" to the United States, established a high standard for future engineer ambassadors to maintain in his address at the dinner given in his honor by the Federated American Engineering Societies at Washington. It is not too much to say that the dinner marked an epoch in visualizing the opportunity for bringing about through the engineer a new basis for international relations. Preceded by Calvin Rice, who presented the opportunity for establishing common purposes between the engineers of North and South America, and by Elmer Sperry, who also was recently an ambassador of engineering good will through his message to the engineers of Japan, the address of Prince Caetani came as a fitting climax to an international evening.

Between the lines of the addresses of all three one common truth was evident, that the engineer who has been and is so definitely responsible for the material advance of our civilization is now viewing himself as one having a responsibility, not alone as an engineer, but also as a citizen, for helping to solve some of the complex problems that this civilization has brought. The Italian Ambassador alluded to this in his address, when he said that he had returned from the war with a great engineering task in view, the draining of the Pontine marshes, but that when the call came to him to serve his country at Washington he felt that the problems of industrial and commercial relations between Italy and the United States could be approached in the spirit of finding the facts and adjusting these international questions on the basis of an understanding of these facts, and in that spirit he had undertaken his new mission.

The addresses of all the speakers emphasized the fact that international relations are not essentially based on mysterious communings between national spokesmen meeting in secret, but on the bringing about

of practical results by discussing with intelligent understanding and in the spirit of mutual respect the industrial and commercial problems between the nations. To this sort of diplomacy the engineer brings an intimate knowledge of the industrial life of his country and the special ability needed in deciding whether a solution proposed will work in practice. With facts expressed for facts' sake in the new diplomacy, is it too much to hope that there will come a mutual respect and tolerance for national motives and ideals that will bring order out of chaos in our world? Certainly this is not a vain hope if truth, common sense, purpose and vision shine in our diplomatic interchanges as they will if men like Caetani are chosen for ambassadors.

Electrification Proves Economical Factor in Port Development

THE revival of shipping following the post-war depression has turned the attention of port engineers to a consideration of those factors which make for increased speed and economy in port operations and are demanded by the keen competition for water-borne commerce between rival ports and terminals. The most restricted step in the cycle of a ship's operations is the handling of the cargo at the port. It is therefore important that human ingenuity devise ways to facilitate cargo handling, and as a result much study is being given to the electrification of port terminals. Electrical material-handling equipment not only speeds up operations and reduces the unit handling costs, but permits a degree of flexibility in handling large volumes of commerce in commodities of all varieties, both in bulk and in package, not obtainable in any other way.

In an article appearing elsewhere in this issue O. P. Seim, mechanical engineer of the port of Seattle, discusses the factors which have entered into the electrification of the Port of Seattle's terminals, the selection and application of motive-power equipment and control, and the layout of the lighting and power circuits. An interesting point which the author brings out is that if the cargo must be moved more than 120 ft. from the side of the ship, then it is more economical to handle it by conveyors, tractors with trailers or other forms of material-handling equipment. There is a vast field of development in the application of electricity to material handling at ports, and a more complete knowledge of the economies derived from the use of electricity would doubtless encourage those concerned with such work.

Talk Plainly to the Stockholder in This Year's Statement

THE season of financial reports has again arrived and the annual statements of the public utilities will be laid before their stockholders for inspection. We wonder how many of these public service corporations will follow the lead of the Commonwealth Edison Company's "Year Book" of 1922 (see ELECTRICAL WORLD, July 1, 1922, pages 1 and 29, and put its story in terms of popular understanding. How many will follow the ancient form of the traditional balance sheet?

The average investor regards an annual report as a sort of mathematical puzzle which he has neither the time nor the energy to solve. He reads the president's message, notes its optimism and its statement of growth, looks at a few totals in the columns of assets and liabilities, and lets it go at that. And yet it is of the greatest importance that the stockholder of any corporation shall understand his company's business and feel not a passive but an active confidence in it.

As a matter of fact, the annual report of the average American corporation is, as a rule, a singularly frank statement of the results of the year's activities. The trouble lies in that the form in which this statement is expressed is highly technical. It is couched in financial jargon, adequate and full of meaning to the trained financial mind, but ambiguous, abstruse and almost unintelligible to the ordinary men and women whose money is invested in the enterprise and who are expected to read it and approve. The steward of their property writes to tell them what he has been doing, but he uses a language that is not clearly understood.

It is a simple matter, as the Commonwealth Edison Company demonstrated so cleverly last year, to make the financial statement of a public utility corporation "talk United States." It is to be hoped that many of the other companies who read this year book saw the point and have remembered, and that this season will see a new type of statement that will speak plainly to the stockholder.

"In Language Understanded of the People"

IN TECHNICAL and scientific circles there is often lamentation over the lack of popular interest in research and of general appreciation of scientific work and attainment. It is in fact true that unless a discovery can be directly coined into dollars, which the most illiterate can fully comprehend, it passes almost unnoticed. Yet this does not really indicate that the man on the street is dull-witted or uninterested in the achievements that lead to a closer knowledge of the mysteries of life and the universe. On the contrary, he is by no means void of intellectual curiosity or unmindful of how far the torch has been borne within a few brief generations. It is chiefly the fault of the highbrow that his works are so often taken at a paper-ruble value. For the highbrow speaks and writes dialects that to the common man are as meaningless as is the superscription on that same worthless spawn of the printing press; and if he looks for real enlightenment, it is generally not to be found unless through translation into another tongue scarcely more intelligible.

At the recent meeting of the American Association for the Advancement of Science, a cub reporter was sent to the scene of action with instructions to summarize what might be of general interest. He was probably, like most of his profession, far above the average in education and intelligence, but all that he brought back was his sense of humor and a collection of titles of papers which looked like printer's "pi" reassembled by a plain drunk. The fact is that technical and scientific men have fallen into the use of language which their fellow mortals can ill comprehend. The jargon of the physicist, the patois of the psychologist, the polysyllabic lingo of the chemist, the pseudo-Hellenic patter of the biologist and the curious argot of the radio fan make a mixture that is enough to drive the common citizen into the arms of the nearest bootlegger. In all seriousness there never was greater need for men who can think straight science and talk straight English. Such there have been in the past —Michael Faraday and John Tyndall, Huxley and Lub-

bock, Sir Robert Ball and the lamented Kingdon Clifford—who in their generation made clear the way. Such interpreters are keenly needed now, for the confusion of tongues has grown steadily worse. Unmasked by fame is the professor who has not, from sheer laziness, devised a new and needless name for an old thing or idea to save himself a casual touch of chalk to blackboard, and lucky is the world if he has not foisted it upon some society to standardize. Our English tongue has thus been cursed by enrichment as Midas by the golden touch, and it has come about that to intricacies of fact have been added those of expression until science repels those who would gladly learn and profit. The situation is a grave one and without good excuse. No modern language surpasses the French in the clarity of its scientific expression, and none is less burdened with the verbiage of the specialist. An ancient English statute prescribed the reading of the Scriptures "in language understanded of the people." We greatly need today the same rational precept applied to the growing body of human learning, so that by many interpreters the truth may be brought to all who are willing to receive it.

Engineering Necessary in Design of Wooden-Pole Lines

TOO little engineering and an excess of rule-of-thumb methods are still applied in the construction of wooden-pole transmission lines in the United States. Starting with the low-voltage distribution line more than twenty-five years ago, when there was little knowledge of the structural features available and attention was concentrated on more vital development problems, wooden-pole construction was developed largely by the cut-and-try method, and eventually the job of designing new lines was left to the line foreman. As the cross-country transmission line developed the wooden-pole line construction in this field followed the distribution methods. If some one guessed wrong, the error could be corrected without much expense. The nature of the steel-tower line precluded going at the problem in this way, with the result that better engineering methods have been developed for use with this type of construction. These methods ought to be extended as a matter of course to the wooden-pole line.

Climatic, topographical and right-of-way conditions are the three principal factors governing the physical features of a cross-country line. The first largely determines the loading to which the structures will be subjected and warrants a careful study of sags and a careful control of the sags determined on during construction. Topographical conditions must be determined by a survey, including in addition to the transit line a carefully run level line. Stadia methods will not suffice for this. Moreover, where the line is erected on side slopes these slopes must be taken to a point beyond the location of the outside conductor on the high side so that conductor clearances can be maintained by proper design. A careful location of all obstructions, lines of other companies and similar factors should be made in the survey. Using these data, a careful pole layout should be made on the drafting board, particular attention being paid to the location of structures to insure the least possible strain under maximum loading conditions. Particular attention should be paid to the elimination of unbalanced strains of any sort. Frequently when lines are constructed on steep slopes a careful study of different pole locations on the slopes will make for a much more desirable loading on the structures. Particular attention should be paid to the elimination of dead ends and the modification of angles to reduce strains. Such studies mean a better line with longer life, less maintenance expense and in the end much better service.

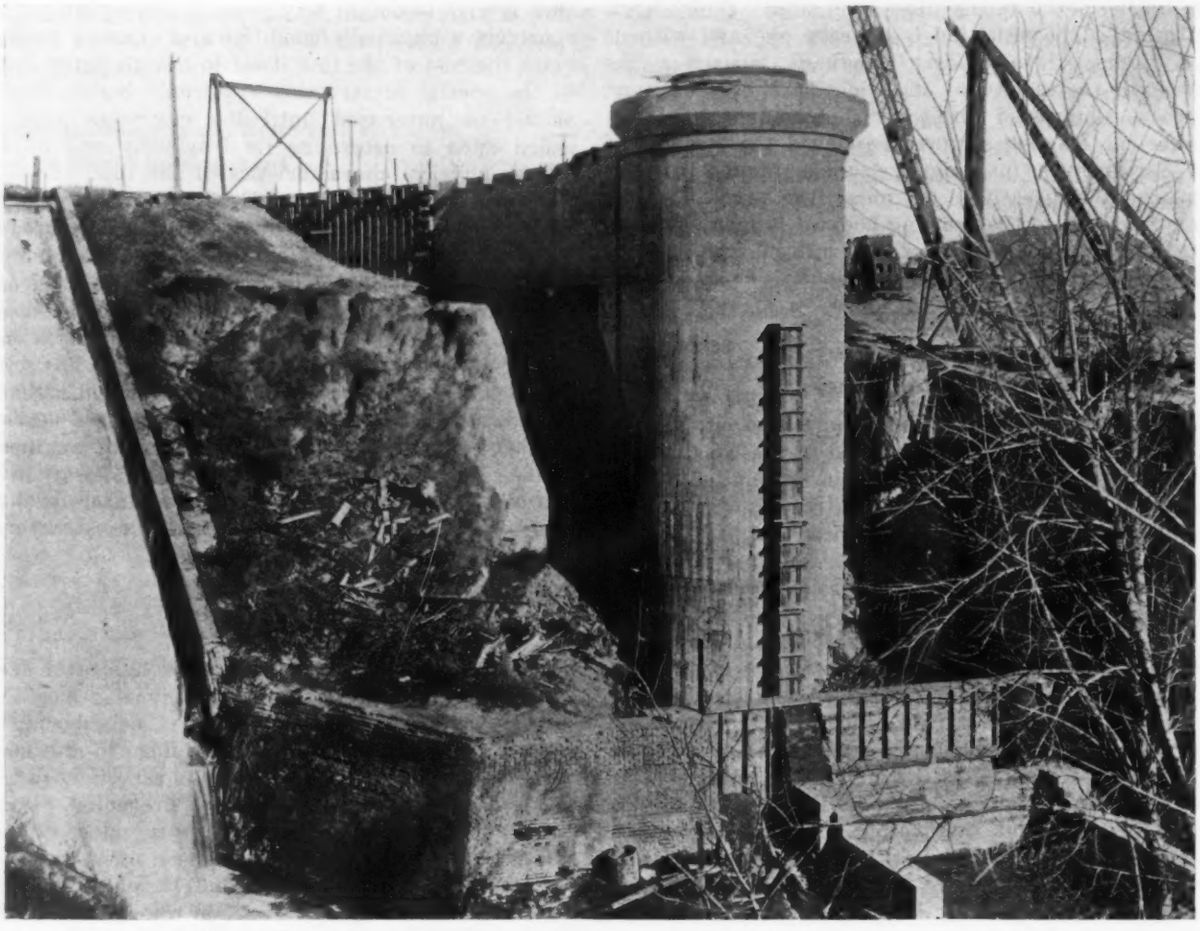
In acquiring a right-of-way it is usually necessary to steer a course founded by economical considerations on one side and by public policy on the other, but the vital effect of the right-of-way on the physical character of the line must not be overlooked. A right-of-way that is easy to obtain may make it almost impossible to construct a physically good line and in many cases may raise the cost of the line itself to a high figure because of the special construction required. No right-of-way should be purchased until the engineers have been called upon to determine its feasibility and its effect on the physical characteristics of the line.

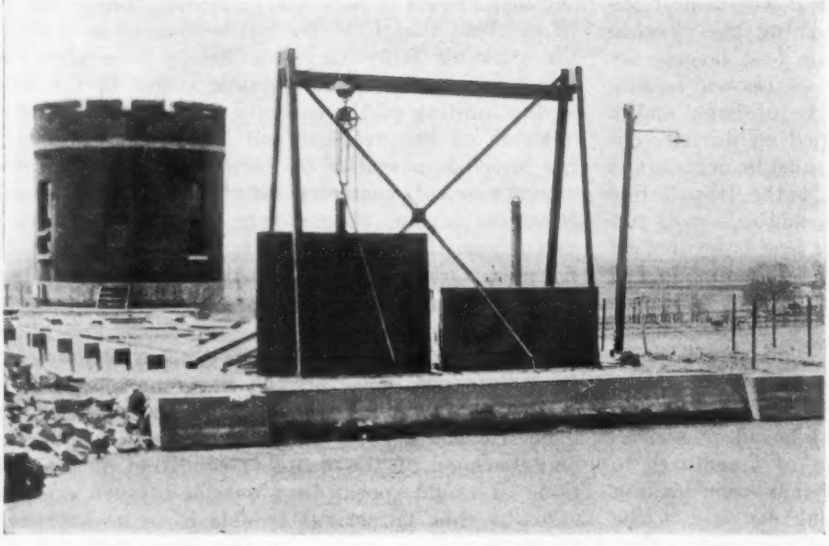
Elsewhere in this issue H. P. Crawford tells of a wooden-pole transmission line constructed in Oregon in which this character of careful engineering has been applied. The stubbing of poles to reduce the cost of construction and to solve a future problem received careful study, and the course indicated to meet a special condition was intelligently carried out. The use of semi-tension insulators in place of dead-end assemblies to reduce strains and meet the demands of service is another piece of intelligent application of engineering facts. The consideration given right-of-way in this instance is well worth the study of engineers who must deal with wooden-pole line design and construction.

Stray Magnetic Fields and Lead Cable Sheaths

A RELATIVELY inconspicuous, though often serious enough, result of the stray magnetic field is the setting up of circulating currents in neighboring conductors. This case obviously is confined to alternating-current circuits. In generators, and especially in transformers, these currents, unless prevented, lead to greatly increased losses and therefore entail expensive modifications in design. A neglect of suitable precautions in these cases immediately leads to trouble, but there is still a third instance in which, in most cases, the disturbance is too small to notice, namely, the losses in the lead sheath of the three-phase cable caused by the rotating stray magnetic field. This phenomenon has never led to serious trouble either in the heating or the limiting of the capacity of the cable. The exact analysis of the problem and the predetermination of the losses is a matter of some difficulty owing to the unsymmetrical geometry of the cable cross-section. However, various approximate computations have been given from time to time, as, for example, that of N. A. Allen in a recent number of the *Electrician*. He concludes that ordinarily the worst result to be expected is equivalent to an increase in the copper loss of about 5 or 6 per cent, which is usually not a serious matter. He points out, however, the importance of even this small increase in extra-high-voltage cables in which the dielectric losses raise the internal temperatures to the neighborhood of the unstable condition of the insulation. It would appear that, outside of such exceptional cases as this, no serious trouble is to be apprehended from the losses caused by the stray fields of linear conductors.

Unusual Design for Kearney Hydro-electric Station





Features of the Kearney Station

A canal conveys the water 16 miles for irrigation and power purposes. The power plant develops 1,500 kw. with a 54-ft. head.

The upper view shows the open concrete flume, concrete standpipe and brick generator house.

The center view shows the combined standpipe and station foundation.

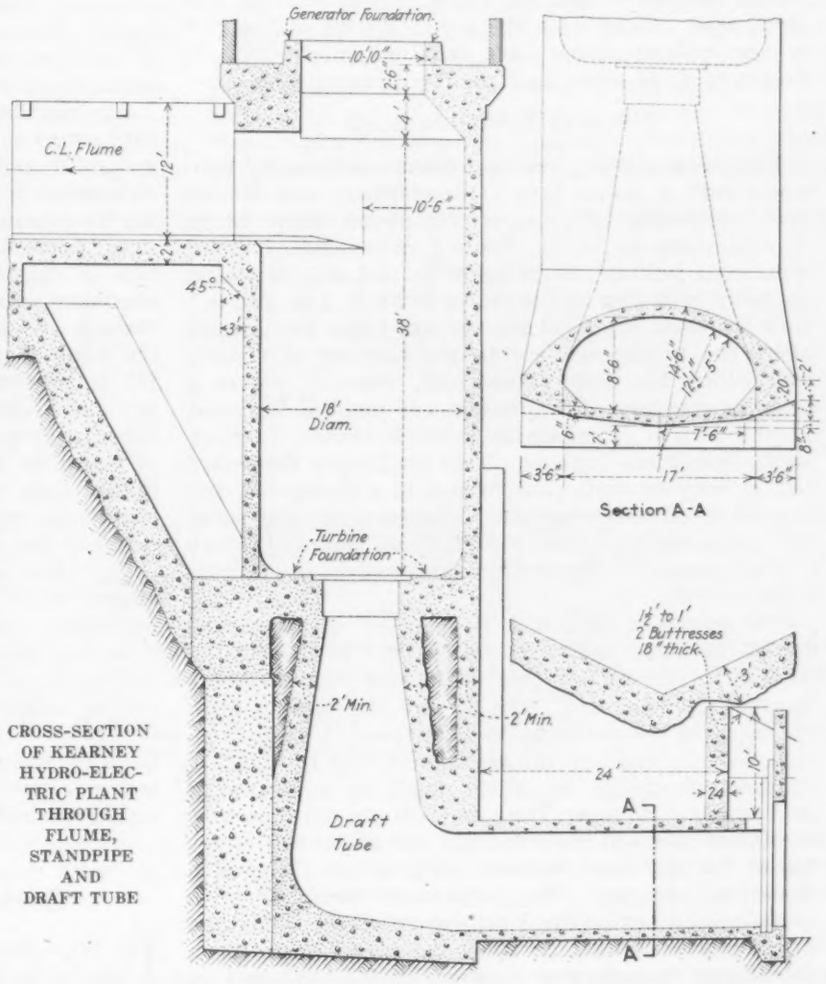
The lower view shows the forebay and headgates.

Design Reduces Cost of Small Hydro Plant

Unusual Ground Conditions Make Conventional Designs Difficult of Application to Kearney (Neb.) Plant and Hence Unique Plan Is Adopted —Output More than Double that of Old Plant from the Same Canal

A HYDRO-ELECTRIC station with some unique features which were adopted largely to fit unusual local conditions was built by the Central Power Company at Kearney, Neb., a subsidiary of the Middle West Utilities Company, during the summer season of 1921. Water for this project is diverted by a low wing dam across the north channel of the Platte River near Elm Creek, Neb., and is carried by a canal for a distance of 16 miles (25.7 km.) to its terminus at Kearney. Water is used for irrigation along the course of the canal during the irrigation season as well as for power development under 54 ft. (16.5 m.) head at the terminus of the canal. At the power station at Kearney is a spillway, the water from this and the draft tubes returning to the Platte River through a tailrace canal about 2 miles (3.2 km.) long. This canal has been in use for many years for irrigation and for supplying the old Kearney power station. The old station was very inefficient and its situation and type of structures did not permit of substantial improvement in economy by reconstruction. It could develop only 600 kw. from the full capacity of the canal.

The new station was completed and put in operation on Jan. 15, 1922, when the flow of water in the canal was restricted by freezing, and yet the new unit yielded somewhat over 1,000 kw. continuously under these conditions. Moreover this increased capacity was obtained at low gate opening since the new unit is rated as a 2,350-hp., 1,875-kva. unit. The plant is now developing 1,500 kw. with virtually the same canal.



CROSS-SECTION OF KEARNEY HYDRO-ELECTRIC PLANT THROUGH FLUME, STANDPIPE AND DRAFT TUBE

The canal at the site of the development is on ground sloping gently southward toward the Platte River and the 54-ft. (16.5-m.) fall is realized, not by the height of the dam or by the height of the canal above surrounding territory, but by a depressed tailrace channel flowing in a deep cut some 50 ft. (15 m.) below the elevation of the surrounding ground surface at the power station. This tailrace cut has been formed by erosion in clay, and the banks stand nearly vertical to the full height except for a small talus accumulation at the bottom—a type of stream channel familiar in the semi-arid districts of the West, where the flow of a stream rapidly deepens the channel but where the rainfall is insufficient to wear the banks back on a flat slope as in older streams and in more humid regions.

As a result, the problem was to design a power plant which would be adapted to the most effective utilization of a canal only 6 ft. (1.8 m.) deep at ground level and carrying 460 cu.ft. (17 cu.m.) per second, the head being obtained by the depth of the tailrace. The tailrace begins about 100 ft. (30.5 m.) away from the foot of the spillway, which is only a sloping surface of the native clay deeply paved to resist the scouring action and absorb the energy of the surplus water in its fall.

The conventional type of station now being built most extensively would call for an intake structure in the bank of the canal and a wood-stave or steel-pipe line about 100 ft. (30.5 m.) long leading to a vertical turbine installed in a steel plate or concrete scroll case about 16 ft. (5 m.) above the tailwater level. The amount of water to be carried would have required a pipe about 10 ft. 6 in. (3.2 m.) in diameter and would have necessitated a somewhat large and elaborate intake structure of sufficient depth to depress the top of the pipe at least 2 ft. (0.6 m.) below canal level, or a total depth of the bottom of the pipe of some 13 ft. (4 m.) below water level; still, this would be required to draw water from a canal only 6 ft. (1.8 m.) deep. A deep

cut in the clay bench would have been required to carry the pipe line down to the elevation of the scroll case at the tailrace, 100 ft. away, and this pipe line would have involved considerable maintenance and depreciation. The scroll case itself would occupy a considerable ground area which would need to be provided by excavating back into the nearly vertical wall of the tailrace channel as no space existed in this narrow, deep channel for any structures. With this arrangement it would have been necessary to slope the clay banks outward in three directions from the power house below to avoid possible caving of banks onto the power house in the deep, narrow cut. Furthermore, the generator would have required a flywheel effect adapted to the 100-ft. inclosed column of water in the penstock and scroll case. In addition the power station at the foot of the spillway would have required sheet piling to protect it from scour, and possibly bearing piles.

UNUSUAL DESIGN SELECTED

For these reasons, and also because of smaller estimated cost, a unique type of development was decided upon, consisting of an open rectangular flume 12 ft. (3.7 m.) deep by 18 ft. (5.5 m.) wide inside, built of reinforced concrete, carrying 9 ft. (2.7 m.) of water, normally, widening at the intake to 33 ft. 4 in. (10 m.) with the same depth. This concrete flume was carried along the ground surface to the edge of the bench, overlooking the deep tailrace cut, where it enters a concrete standpipe, 18 ft. (5.5 m.) in internal diameter, at the bottom of which is a single-runner, vertical-shaft, open-flume turbine. This discharges downward into a concrete draft tube formed in a downward continuation of the standpipe structure of the same external diameter. The draft tube discharges through a short passage under the talus material to the tailrace canal.

The standpipe extends 3 ft. 6 in. (1 m.) above the top of the flume, expanding in diameter to about 25 ft. (7.6 m.). On top of this is a brick superstructure housing the generator. The floor of the flume is monolithic from the intake to the standpipe, this construction being adapted on the assumption that it will have sufficient flexibility to adjust itself to any unequal settlements. However, the side walls are provided with expansion joints at the standpipe and at the pier at the top of the clay slope, between which points the ground slopes off abruptly. The purpose of the joints is to accommodate any unequal settlement of the flume and of the concrete standpipe, which has a total height from foundation to generator floor of 78 ft. (23.7 m.) in addition to the height of the superstructure of 22 ft. (6.7 m.).

The excavation in which the combined standpipe and station foundation was built was carried 4 ft. (1.2 m.) below the bottom of the discharge tunnel, and a test was made to determine the bearing resistance of the clay bottom at this point. A load of 8 tons per square foot produced a compression of the soil of only 0.16 in. (4 mm.). This clay had been subjected to a compression load of 3 tons per square foot (0.25 t. per sq.m.) in its natural state because of the height of the clay bank in which the pit was dug. The load imposed by the standpipe structures was about 4 tons per square foot (0.33 t. per sq.m.), and no measurable movement whatever of the expansion joints has occurred since completion to indicate any settlement in this structure.

The turbine deck in the standpipe is 41 ft. (12.5 m.) below the top of the flume, 38 ft. (11.6 m.) below normal water level in the flume, and 44 ft. 6 in. (13.5 m.) below the generator-floor level. As mentioned before, the turbine is a single-runner, vertical-shaft, open-flume unit rated at 2,350 hp. at 54-ft. (16.5-m.) head. Two sections of extension shaft connect it with the generator above. In view of the unusually large head for an open-flume turbine, the crown plate is especially well braced against distortion by two tangential struts to the standpipe walls. All bearings are separately lubricated by a grease compressor on the generator floor. The unit is controlled by a governor on the same floor.

The generator is a 1,875-kva. machine, operating at 225 r.p.m., 60 cycles, three-phase, with a direct-connected exciter. All leads from the generator are carried through conduit to the existing steam station of the company about 200 ft. (61 m.) to the eastward, from which point the unit is controlled.

The installation of the turbine in the standpipe structure serves to reduce the required flywheel effect of the generator and allows the turbine to be assembled or dismantled through the flume entrance without disturbing the generator. The velocities through the trash racks, in the flume and in the standpipe are very low. The draft tube is designed as a straight diverging cone of the maximum possible length permissible without danger of vacuum and is provided with an elbow which spreads the water from a circle of 11 ft. (3.4 m.) diameter at the upper end of the elbow to a width of 17 ft. (5.2 m.) and height of 8 ft. 6 in. (2.4 m.) in the discharge tunnel. From the results obtained and from analysis of hydraulic losses it is believed that the efficiency is higher than could have been obtained with the relatively high velocities in the intake, pipe line and scroll case had the conventional setting been adopted.

The total cost of the installation was about $119,000, amounting to about $50.60 per horsepower of turbine installation, or about $63.50 per kilovolt-ampere of generator capacity.

This project was engineered by L. F. Harza, consulting engineer of Chicago, with the approval of George W. Hamilton, engineer of the Middle West Utilities Company of Chicago, the holding company, and was executed by D. D. McNabb as construction superintendent.

Curious Case of Electrocution

IN THE *Revue Générale de l'Electricité* A. Turpain tells of an unusual fatal accident from electric shock. Wires used for radio-telephonic communication between two stations on a distribution network ran parallel to the high-tension lines at a distance of 1.80 m. from the latter. On cutting one of these wires a workman received a fatal shock notwithstanding the fact that the wire was isolated from any source of current and did not touch the high-tension line either before or after being cut. The author attributes the mishap to a capacity effect, current being induced in the circuit (containing the capacity and including the workman) by the 15,000-volt current in the adjacent lines. He maintained that workmen should not be allowed on structures carrying high-tension lines until the latter have been disconnected, even though work is not to be done on those lines themselves. This precaution is particularly necessary when work is to be done on lines running parallel to the high-tension lines for some distance.

Ash Handling for Central Stations*

High Maintenance Costs of Mechanical Carrier Systems Outbalance Charges on Hopper Car and Air Systems—Practice in Some Stations Tending Toward Water Sluicing of Ashes

THE primary object of a modern central-station system of ash handling is to reduce both labor and depreciation charges to a minimum. To accomplish this any method adopted for a given plant will be governed by the way the ashes are delivered from the fire and also by the facilities for final disposition. With the development of large power boilers yielding ashes at a rate of over a ton per hour, modern ash-handling equipment has been required to keep pace with the boiler development rate. As a result four distinct types of ash-handling equipment have appeared, namely, hopper ash pits dumping direct into freight cars, mechanical conveyors, air conveyors, and conveyors using water as a means of motion.

The design of hopper ash pits, which are used most extensively in modern plants, depends upon the method of ash removal and the draft system. With underfeed and chain-grate stokers dumping ashes at the rear of the furnace, the top of the hopper will be the width of the fire but of small dimension from front to rear. This reduces the capacity for storage. In some instances very little capacity may be sufficient owing to storage facilities outside the ash pit, but twenty-four-hour capacity should usually be provided for in case of breakdown in the conveyors. The largest ash-pit capacity will be required with conveying systems which are operated intermittently; for example, where ashes are dumped into standard railway cars or into conveyors which might be choked by the direct dumping of an accumulation containing large clinkers and therefore need manual attention.

In the design of the hopper ash pit the sides should slope not less than 45 deg. in any case, but if one side is vertical, the opposite side may have the minimum slope. If the slope is too small, arching of the ash is likely to occur. This will increase operating costs owing to the frequent necessity of poking bars up through the discharge doors to start a flow of ash. Where the width of the hopper would necessitate too great a height to get these required slopes, the ash pit may be divided into a number of discharge openings. Modern practice requires discharge openings of about 30 in. to 36 in. (76.2 cm. to 91.4 cm.) as a minimum, although their size depends upon the method of firing. When small anthracite is burned with sufficient steam in the combustion air, no clinkers are formed; but modern intensive firing of bituminous coal tends to cause the formation of large clinkers. Therefore the discharge opening should be large enough to pass these without having to break them into smaller pieces.

The height of the bottom of the hopper above the basement floor depends upon the system of conveyors adopted. With a locomotive and standard railway cars about 17 ft. to 18 ft. (5.18 m. to 5.48 m.) is required; but with industrial cars 5 ft. to 6 ft. (1.52 m. to 1.82 m.) is sufficient, although a clear head room of 7 ft. (2.13 m.) is preferable. Many designers prefer to make the hopper sufficiently large to allow the ashes to remain long enough to cool naturally. By allowing some ash to remain (when dumping) for the new hot ash to fall on the doors and linings are protected.

Although shells with reinforced concrete about 6 in. (15.2 cm.) thick have been found satisfactory, the most modern construction is to use a structural steel skeleton and a shell of substantial cast-iron flanged plates bolted together. Corrosion is not troublesome because cast

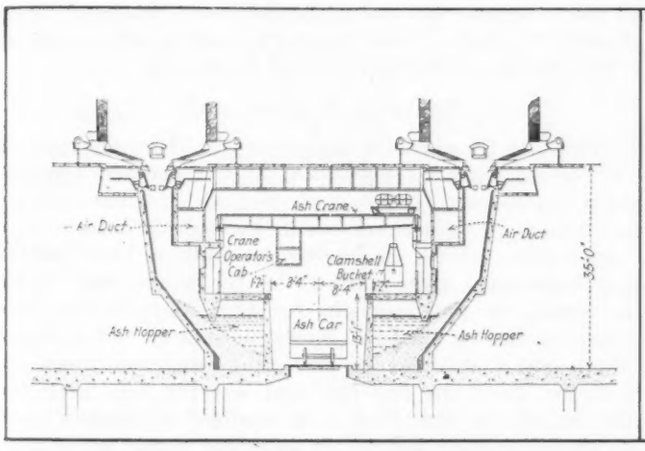


FIG. 1—WATER-SEALED ASH PIT FOR THE SPRINGDALE STATION OF THE WEST PENN POWER COMPANY

Installation of the type shown in Fig. 1 requires a head room of 35 ft. (10.66 m.), but has a capacity of three days' operation at 200 per cent continuous rating of the boilers. Removal of ashes from the ash pits is by traveling crane and clamshell bucket. One crane operator handles the ash output of the station in two hours per day. A further advantage of this method is that no combustible or corrosive gas escapes into the basement to cause trouble to the operating force.

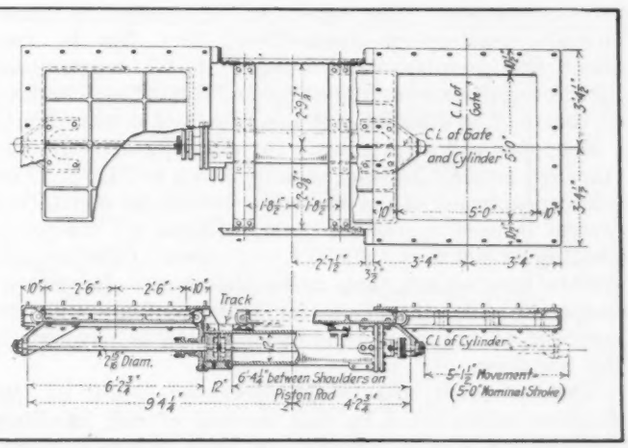


FIG. 2—THIS POWER-OPERATED ASH DOOR HAS A WATER SEAL WHEN CLOSED

*An abstract of the paper presented before the American Society of Mechanical Engineers, Dec. 4, 1922, by John Hunter and Alfred Cotton, St. Louis.

iron suffers much less than steel. By properly quenching the hot ashes with water sprays a lining of well-burned hard paving brick proves satisfactory.

Hopper ash pits will usually be provided with doors to retain the ash, to prevent the passage of air and also to allow the ashes to be dumped. With chain grates and with closed-ash-pit forced draft the doors should be tight to avoid a loss of air pressure and waste of blower power. There are several ways in which dump openings may be sealed. Doors and faces may be machined, flanges may be provided around the edge to maintain a water seal, or the frame may be provided with a groove packed with asbestos rope, while the door has a rib or tongue which is squeezed into the asbestos packing by a cross bar and screw spanning the door. One type of dumping gate which retains a water seal when closed is shown in Fig. 2.

The method of conveying ash by emptying ash pits into small dumping cars has a great deal to recommend it since the cars are usually so inexpensive that one or two spare idle cars are not objectionable; also because the cars can be repaired without interrupting the ash conveyance. The cars can be moved by men, animals, tractors or locomotives; they can be run about the premises and dumped to fill depressions, lifted on elevators to dump into an elevated ash bunker, or they can be dumped into the bucket of a whip hoist.

A hopper ash pit arranged for dumping directly into standard gondola railway cars is shown in Fig. 3. The coal consumption of the particular station in which this system is used is 413,000 tons (374,665 t.) per year, yielding 52,800 tons (47,800 t.) of ashes. Careful time studies have shown that, using the electric locomotive and crane (also in service for coal handling), only 25 per cent of the total time of operation is devoted to ash handling.

The estimated cost of the increased height of the building necessitated by this method of ash handling is liable to arouse comparison with other systems. About 45 lb. (20.4 kg.) of compressed air is required daily to operate the hopper ash-pit dumping doors. From recent tests it was found that 1,030 gal. (3,398.4 l.) of water is used in spraying one ton of ashes. This amounts to about 4 per cent of the total general service water used by the station.

MECHANICAL CONVEYORS

By installing a skip-hoist system at the Ashley Street station of the Union Electric Light & Power Company, St. Louis, in 1916, operation and maintenance expenditures were appreciably reduced. This system is shown in Fig. 4. The old installation, built in 1905, required sixteen men to operate the ash-removal system. This was mainly due to the fact that the men were not allowed to travel on the elevators, which were inspected for freight only. In the old system two men were required to load the cars and drive the mules, two men to run the full cars onto the elevators and to remove the empties, and two men were needed at the top to run the cars off the elevator and dump them into the ash bunker—making a total of six men for each of the two day shifts and four men during the midnight shaft.

The new installation consists of a bucket worked by a skip hoist and a storage-battery locomotive to haul the ash cars. Operation of this system is satisfactory and has given good service. It has reduced the ash-handling labor cost one-third and the cost of maintenance one-half. Experience with storage-battery locomotives shows, however, that in the heat of the basement the electrolyte evaporates rapidly, resulting in battery trouble. A gasoline locomotive is now employed and gives entire satisfaction.

With the chain and bucket forming a ring system (illustrated in Fig. 5) a conveyor may be used for coal in the daytime and for ash at night. The coal is received from crushers at one end of the building and elevated to a point above the bunkers into which the buckets are discharged. The ashes are dumped into buckets during the lower run under the ash pits, elevated and dumped into an ash bin which can be discharged into railway cars or motor trucks. The building of this installation occupies the entire site and no projections of any kind were possible. Since the basement floor was 12 ft. (3.65 m.) below the alley level and as the alley was only 15 ft. (4.75 m.) wide, it was found necessary to build a recess into which the trucks could drive, dump coal and then load up with ashes. Since the ash-bunker discharge is directly above this recess, a truck can be filled with ashes as soon as it has delivered the coal to the receiving bunkers. This makes for quick unloading and reloading, which materially increases the road time of the trucks.

CONVEYOR MAINTENANCE

Owing to the abrasive nature of ash, the maintenance cost of mechanical conveyors is high. The ashes grind away the connecting pins, and even with regular renewals the pins sometimes wear excessively and cause breakdowns. With a ring-bucket system breakdowns are sometimes quite serious as the ashes may have to remain in the basement for some days before the conveyor can be placed in operation again. When handling coal and ashes in the same conveyor there is difficulty from the fine coal and wet ashes packing in the buckets, so that there is a needless continuous load on the equipment and a corresponding reduction in the carrying capacity. The water which leaches from the ashes is exceedingly corrosive and helps to carry the fine abrasive ash into the wearing parts.

The life of these conveyors is considered to be about seven or eight years, with extensive repairs necessary every two or three years. The excessive cost of maintenance of ash conveyors of this kind has led to their replacement in some installations with electrically operated cars carrying the ashes to outside pits from which they are loaded into railway cars with a bridge crane. This has resulted in lowering handling costs about 50 per cent.

Both the Fisk Street and the Quarry Street stations of the Commonwealth Edison Company, Chicago, are equipped with bucket conveyors which handle both coal and ashes. It was the intention to install four such conveyors at the Fisk Street station, but only three were installed since the cost of operation and maintenance proved too high. The parts of the fourth were used to repair the three others. An electrically operated ash car is now used in place of the fourth conveyor, and the three other conveyors are being replaced with similar ash cars. These cars are dumped into a pit outside of the building and a bridge crane takes the ashes from the pit with a grab bucket and loads them into railway cars. The cost of maintenance is almost negligible compared with that for the apron conveyors.

At the Northwest and Calumet stations, Chicago, the ash is dumped from hopper ash pits directly into rail-

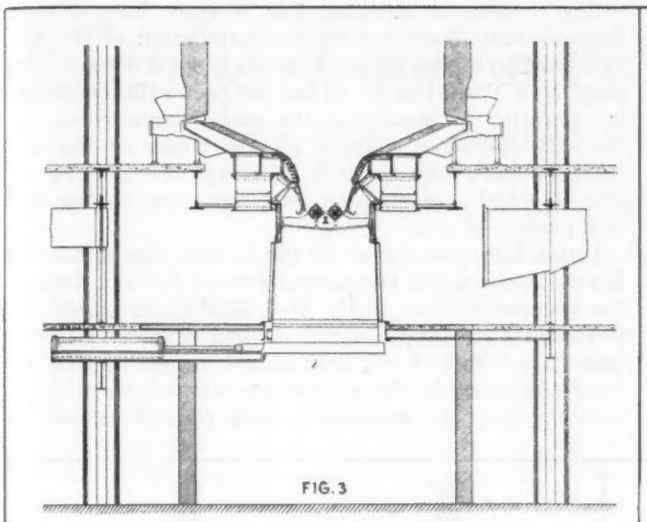


FIG. 3

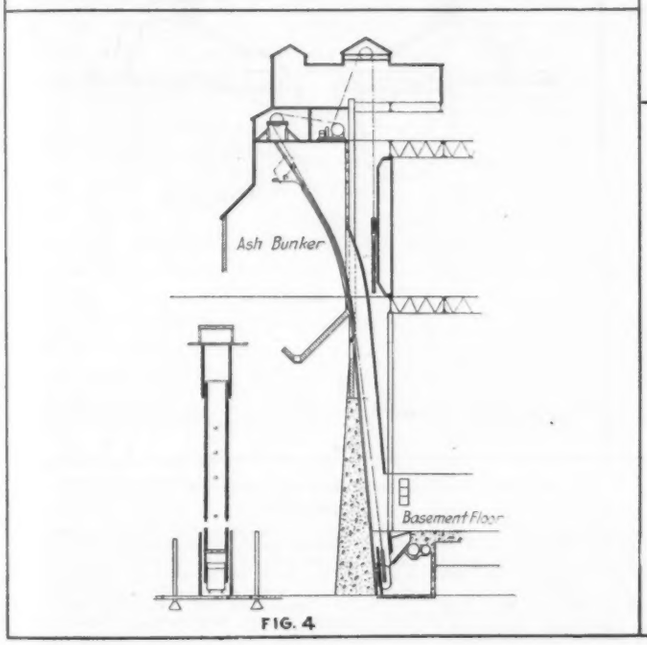


FIG. 4

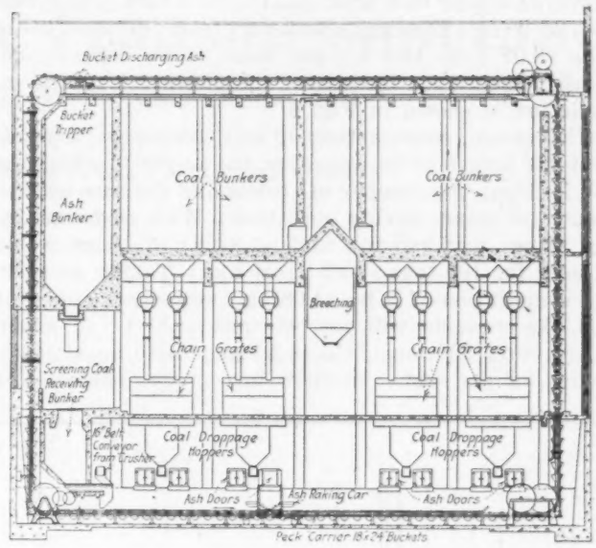


FIG. 5

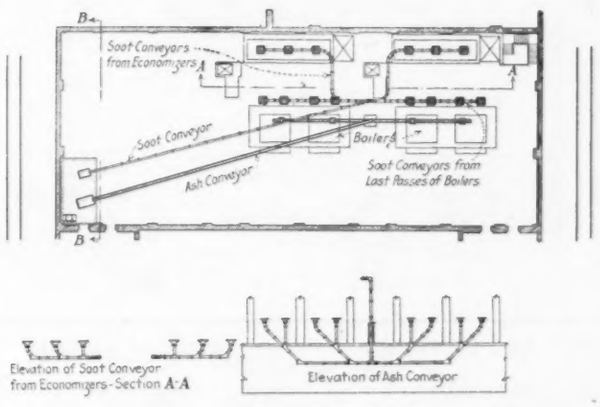


FIG. 6

ASH-HANDLING EQUIPMENT IN USE IN MODERN CENTRAL STATION PLANTS

Fig. 3—Hopper ash pit for dumping into standard gondola railroad cars. The hoppers are lined with brick (not shown) and have a capacity of 2,500 lb. (1,134 kg.) of ash. The stokers are equipped with clinker grinders and the ash gates are of the sliding type and are operated by compressed-air cylinders.

Fig. 4—Automatic skip hoist at Ashley Street Station of Union company, St. Louis. When an ash car has been dumped into the bucket a switch is pressed which starts the hoisting motor raising the bucket to the top of the travel, where it turns over and discharges into the elevator bucket. A trip switch at this point reverses the motor, thus lowering the bucket to the starting point, where another trip switch stops the motor. One pressure of the button therefore results in hoisting and dumping the bucket and returning it to the starting point, ready for another load.

Fig. 5—Typical example of the continuous conveying systems which can be used for both coal and ash handling.

Fig. 6—Air conveyor at Milwaukee Power plant conveys a minimum of 12 tons (10.88 t.) per hour at a steam consumption not exceeding 325 lb. (147.4 kg.) of steam per ton of ashes. Feed pipes with a bore of 9 in. (22.8 cm.) are run from the four 734-hp. boilers equipped with underfeed stokers to the storage bunkers inside the boiler house. This storage bunker has a single slope bottom and is emptied through a movable chute into railway cars below. The conveyor for soot and fly ash is connected to the ash conveyor and has a bore of 6 in. (15.2 cm.).

way cars, so that the only maintenance required is the upkeep of ash-pit linings and dumping doors. The cost of the ash-handling equipment at these stations cannot well be estimated since they are recent installations. Owing to the fact that the buildings must necessarily be higher in order to afford head room under the ash pits, the increased cost of the greater height must obviously be chargeable to the ash-handling system.

The salient advantage of fluid conveyors is that there is no mechanism to wear out. The two classes now in common use are the air and water conveyors. As the velocity in air conveyors is high, the abrasive effect is also large and the wear is especially heavy at the elbows.

With the air-conveyor system there are two methods of generating the air current. In one the pipe outlet is connected to the ash-storage tank, in which a vacuum is caused by means of a steam jet, and in the other the air current is induced by a steam jet between the ash intake and the outlet. It is customary to locate the motor jet at an elbow as it is then convenient to aim the jet in the new direction. Ash openings may be arranged in any position desired, such as in the firing floor in front of hand-cleaned ashpits, near the bottom of hopper ash pits, or connected to pipes to draw soot and fly ash from the later boiler passes. They can serve several lines of boilers as easily as one. The maximum capacity of a 6-in. (15.2-cm.) conveyor is about 4 tons

(3.62 t.) of ash per hour; that of the 8-in. (20.3-cm.) conveyor 6 tons to 9 tons (5.44 t. to 8.16 t.), and that of the 9-in. (22.8-cm.) conveyor from 10 tons to 15 tons (9.07 t. to 13.6 t.) per hour. This capacity depends largely upon the size of the pieces. A typical installation is shown in Fig. 6.

The steam consumption of air conveyors depends upon the length of the conveyor, the height to which the ash is lifted, the number of bends and the care used to economize steam during operation. With coal containing 12 per cent ash two tons (1.81 t.) of steam would be used for 100 tons (90.7 t.) of coal. Taking an average evaporation of 9 lb. (4.08 kg.) water per pound of coal, the conveyor will use two tons (1.81 t.) of steam out of every 900 tons (816.46 t.) generated, or approximately 0.2 per cent. To allow for careless operation it is advisable to allow from 0.3 to 0.4 per cent in arranging for extra distillation for make-up water. If the make-up water for the station is 2 per cent, then the distilling capacity should be increased by 20 per cent.

To prevent waste of steam in air-conveyor systems there is on the market an electrically controlled steam valve which consists of a foot-operated switch placed in a convenient position near each ash intake so that steam is actually blowing only when the attendant is actually at work at any particular intake.

The Lakeside plant of the Milwaukee Electric Railway & Light Company in using the air-conveyor system (Fig. 7) has all the conveyor lines constructed of 8-in. (20.3-cm.) cast-iron pipe with a running length of two main lines of approximately 200 ft. (60.96 m.) and a vertical rise of 65 ft. (19.81 m.). In two years of operation the only maintenance required has been the replacement of one nozzle. Since this station uses pulverized fuel, the ash from the combustion chamber is a fine powder which is easily handled by the air conveyor.

The system of dumping ash directly into an open flume is best illustrated by the installation at the Hell Gate station of the United Electric Light & Power Company, New York, Fig. 8. It has not been sufficiently long in operation to determine the maintenance costs, but the only operating charges are the wages of the ash-crane operator and the cost of energy for driving the pumps, which are running only according to the load and quality of coal.

In the Lacombe station of the Denver Gas & Electric Light Company the same arrangement for ash disposal has been adopted as in the Hell Gate station, with the exception that there are no clinker grinders. Consequently, instead of the ground ash dropping into the flume continuously, the stokers are dumped at intervals, sending down a considerable bulk of ash containing large clinkers. The flumes are therefore protected by a "grizzly" composed of heavy bars set 6 in. (15.2 cm.) center to center to withstand breaking up the large clinkers until they can drop between the bars into the flume.

This system handles about 33 tons (29.93 t.) of ashes every twenty-four hours. Stokers are dumped at intervals of two to two and a half hours. The water does not flow continuously, but when the fireman is about to dump ashes the pump is started and when the sluiceway is filled with water, the ashes are dumped from one boiler at a time into the swiftly moving water. A whistle signal is in use between the fireman and the ash tender. The ashes are then recovered from a settling tank by a grab bucket and given to the city for suburban road making. Three combination men, one on each shift, are required to handle the ashes and attend to the feed pumps. Two men, one on each of the two shifts, operate the crane and clamshell bucket to remove the ash from the settling tank.

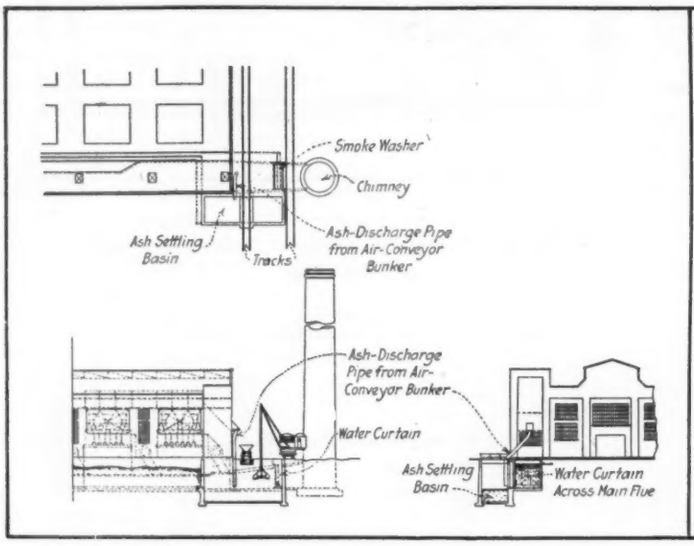


FIG. 7—AIR CONVEYOR AND SMOKE WASHER AT LAKESIDE PLANT, MILWAUKEE

The conveyors discharge into ash bunkers, there being one bunker for each side of the boiler room containing eight boilers arranged in two rows of four each. The ash from one bunker is discharged into cars, while the other is emptied down a closed chute into the ash-settling chamber of the smoke washer. The latter is installed in the main flue about 20 ft. (6 m.) before it enters the base of the stack. The water from the smoke washer runs into a trough formed at the bottom of the flue and then runs off into a concrete settling basin carrying the ashes it collects. This basin is 45 ft. (13.71 m.) long, 16 ft. (4.87 m.) wide and 25 ft. (7.61 m.) deep, which allows the water to settle. When the ash subsides it is removed by a clamshell bucket operated by a locomotive crane.

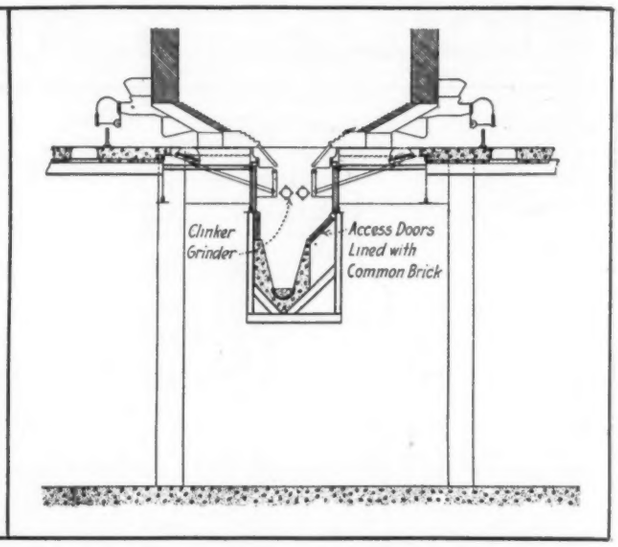


FIG. 8—WATER CONVEYOR AT HELL GATE STATION, NEW YORK

Open flumes (Fig. 8) run under each row of boilers and connect with a closed cross pipe leading to the ash-settling tank. The ashes are recovered from this settling tank by a grab bucket operated by a locomotive crane and discharged into scows which are towed out to sea. The flumes within the boiler room are of concrete with a bottom lining of vitrified earthen drain tiles or half pipes. There are two nozzles in each flume, one at the head and the other an undercurrent nozzle at the beginning of each succeeding ash pit. These undercurrent nozzles are at the bottom of the flume and are arranged to discharge horizontally downstream to avoid contamination of the circulating water.

Design of Wooden Pole Transmission Line

Tests Made to Determine the Most Suitable Material for Stubs Prove of Much Value—General Features of Design Adopted by Central Station Company in the Pacific Northwest

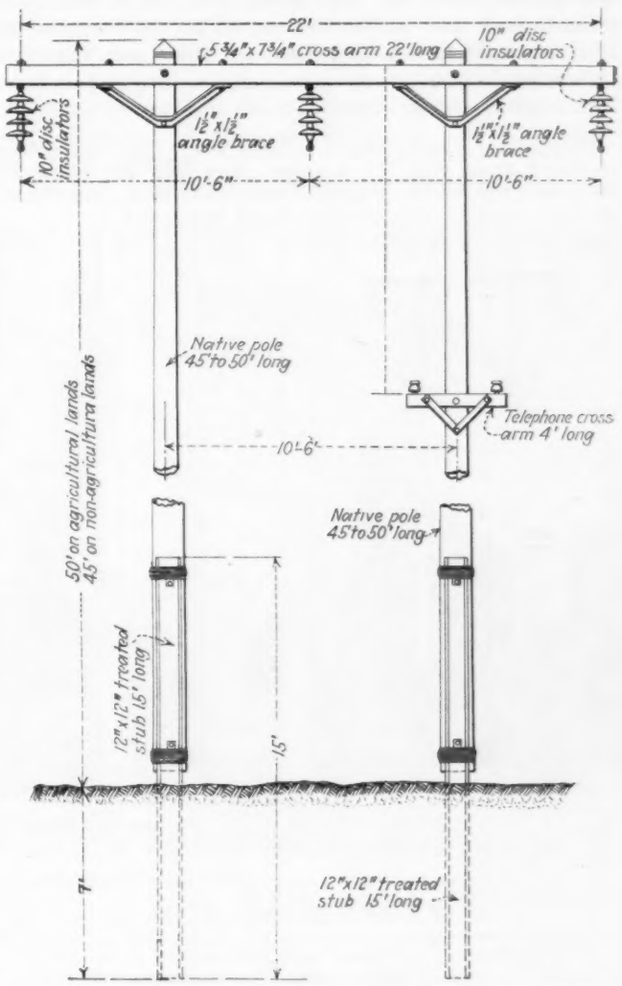
By PERRY O. CRAWFORD

Chief Engineer The California Oregon Power Company, Medford, Ore.

THE construction of a transmission line through rough and mountainous country presents unusual problems in the transportation of materials and in the design of the line to keep down construction costs to the minimum consistent with durability and good engineering practice. The California Oregon Power Company had such a problem in the construction of a 123-mile, 110,000-volt transmission line recently built between its Prospect hydroelectric plant in southern Oregon and the town of Springfield, Ore., in the upper Willamette Valley. A contract was entered into on Dec. 30, 1921, between the Mountain States Power Company and The California Oregon Power Company whereby the latter was to deliver power to the system of the former beginning not later than Jan. 1, 1923, and sooner if the construction of the line should be completed before that date.

The country lying between the systems of these two companies includes two main divides, one between the Rogue River Valley and the Umpqua Valley and the other between the Umpqua and the Willamette River valleys, and in addition a number of steep divides between the minor drainage systems. The southern portion of the intervening territory, particularly on the Umpqua-Rogue divide, is very heavily timbered. In selecting the general route for the line the factors considered were: (1) Accessibility from roads and trails, as affecting construction, patrolling and maintenance, particular attention being given to maintenance; (2) directness of route; (3) avoiding, as far as possible, broken terrain, by following ridges and valleys; (4) avoiding heavy timber as far as practicable; (5) keeping in as low an altitude as possible in order to avoid regions of heavy snowfall. Accessibility and avoidance of heavy clearing were very important from the standpoint of patrolling and maintenance as well as from the standpoint of first cost and time required for construction, as it was essential that the entire line be completed in the one season.

The route as finally selected parallels county roads and highways for a considerable portion of its length, and


22'
5 3/4" x 7 3/4" cross arm 22' long
10" disc insulators
10" disc insulators
1 1/2" x 1 1/2" angle brace
1 1/2" x 1 1/2" angle brace
10'-6"
10'-6"
Native pole 45' to 50' long
Telephone cross arm 4' long
10'-6"
50' on agricultural lands
45' on non-agricultural lands
Native pole 45' to 50' long
12" x 12" treated stub 15' long
15'
7'
12" x 12" treated stub 15' long

IMPORTANT DETAILS OF TWO-POLE WOOD TOWER USED ON TRANSMISSION LINE OF THE CALIFORNIA OREGON POWER COMPANY

TABLE I—COMPARATIVE COSTS OF TWO KINDS OF CONSTRUCTION FOR MOUNTAIN SECTION

Cost of Stubbed Pole at the Hole:	
Price of stub, f.o.b., point of railroad delivery	$10.50
Cost of bolts and lashing material	1.50
Maximum stub haul to line at 25 cents per ton-mile (600 lb., 45 miles)	3.35
Haul along line, 3 miles, on road	1.00
Dragging stub with team, 5½ miles to summit	7.50
Cost of native 45-ft. fir pole at the hole	5.00
Labor lashing to stub	1.25
Total	$30.10
Cost of Treated Cedar Pole at the Hole:	
Idaho cedar pole, "pentrex"-treated, 50 ft. long, 8-in. top	$21.00
Haul to line, 45 miles	7.30
Haul along line, 3 miles, on road	1.95
Dragging 5 miles along line to summit	15.00
Total	$45.25

no point on the line is more than 7 miles from an existing road. From Springfield south the first 32 miles of the line closely parallels the highway and county roads. South of this there is a timbered ridge not accessible from any road. For the next 50 miles the line is at no place more than 5 or 6 miles from a crossroad, with closely paralleling roads for about 20 miles. Throughout the mountain section, a distance of 27 miles, there is only about 8 miles of paralleling road and only one crossroad, these being rough mountain roads. For the last 14 miles there is practically no road, and the shortest point from the line to the railway is approximately 45 miles. This portion of the line passes through rough mountainous country and crosses the Umpqua-Rogue divide at an elevation of 4,400 ft. Another divide is crossed at an elevation of 3,500 ft

Single-pole construction with 350-ft. spans was used for the first 28 miles because this section of the line lies along roads and highways. For the remaining distance of 95 miles two pole towers were used, the standard span over level ground being 500 ft. The wire throughout is seven-strand, No. 00 medium-hard-drawn copper. Suspension construction was used with 10-in. ball-and-socket disk insulator units. The two-pole tower construction was not used at the north end on account of being too wide to be placed along the highways. On farming and orchard lands a single pole is less objectionable for the reason that there are fewer poles though more structures per mile. The single-pole line averages fifteen and one-half poles per mile and the two-pole line twenty poles, or ten towers per mile. The general specifications for the line were:

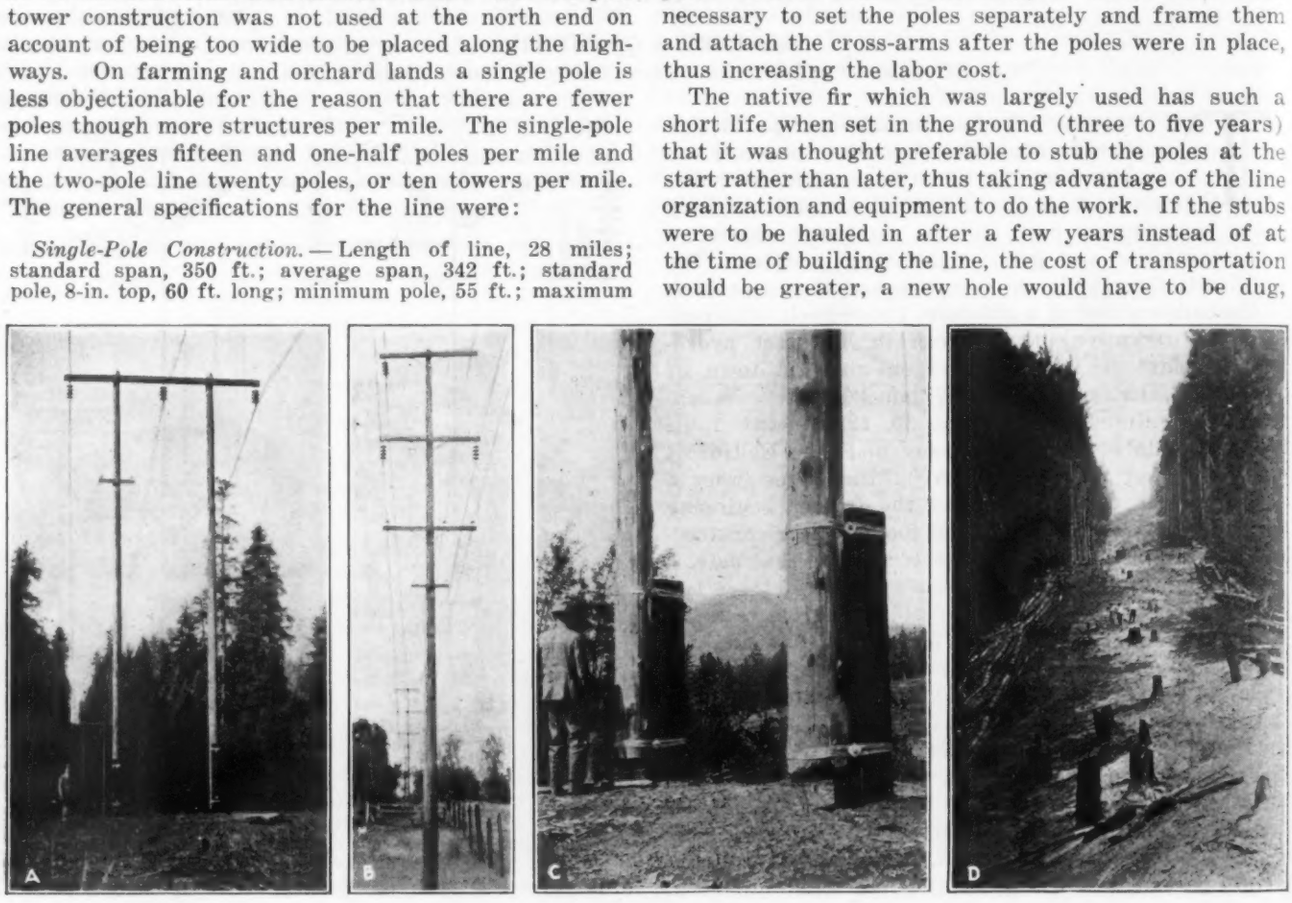
Single-Pole Construction. — Length of line, 28 miles; standard span, 350 ft.; average span, 342 ft.; standard pole, 8-in. top, 60 ft. long; minimum pole, 55 ft.; maximum pole, 70 ft.; poles, Idaho cedar, "pentrex"-treated; cross-arms, 4½ in. x 6½ in. x 11 ft.; conductor spacing, 10-ft. horizontal and vertical, right-triangle configuration.

Two-Pole Tower Construction.—Length of line, 95 miles; standard span, 500 ft.; average span, 550 ft.; longest span, 1,702 ft.; standard pole, 45 ft., lashed and bolted to stub; poles, native fir, native cedar and seasoned fir; stubs, 12 in. x 12 in. x 15 ft., treated fir; spacing of poles, 10 ft. 6 in.; cross-arms, 5¾ in. x 7¾ in. x 22 ft.; conductor spacing, 10 ft. 6 in., flat.

The two-pole construction is unusual in that the poles were attached to stubs at the time the line was built. On account of the high cost and difficulties of transportation and the presence of native timber close to the holes, it was found more economical to haul in a treated stub and bolt the pole to it than to haul in treated cedar poles. The comparative cost of the two types of construction is shown in Table I. It will be seen that the additional cost of a treated cedar pole over that of a native fir pole bolted to a treated fir stub is $15.15. Hence the additional cost per mile for the cedar-pole construction at the summit of the highest divide or the most inaccessible point on the line would be, for twenty poles or ten towers to the mile, $303. In addition, the construction problem was simplified and the labor cost of erecting the towers reduced by the use of stubs, because it was possible to install and line up the stubs with ordinary labor and then for the erecting crew to frame the tower, attach the cross-arm and braces and raise it as a unit. Had cedar poles without stubs been used, it would have been necessary to set the poles separately and frame them and attach the cross-arms after the poles were in place, thus increasing the labor cost.

The native fir which was largely used has such a short life when set in the ground (three to five years) that it was thought preferable to stub the poles at the start rather than later, thus taking advantage of the line organization and equipment to do the work. If the stubs were to be hauled in after a few years instead of at the time of building the line, the cost of transportation would be greater, a new hole would have to be dug, and the rotten butt would still be in the ground to weaken the setting. The creosote-treated stub used is also a better fire risk than the untreated native pole, as has been shown by the tests and experience of many telephone and power companies. In attaching the pole to the stub a clearance of 6 in. to 8 in. was left between the ground and the butt of the pole to prevent butt rot. It is estimated that the life of these stubs will be longer than that of the best treated cedar poles on account of the greater penetration obtained by the closed-tank treating process commonly used for ties and piling. It is conservatively estimated that these stubs will have a life of from thirty to forty years.

A series of tests was made to determine the proper size and kind of stub and type of lashing required to develop a strength equivalent to that of the pole. The stubs tested included fir and cedar of various sizes as well as fabricated steel. The results of the several tests are given in Table II. From the results of these tests it was decided to use a sawed Douglas



GENERAL VIEWS OF POLE-LINE CONSTRUCTION

A—Typical two-pole transmission-line tower used in the mountainous sections.
B—Typical single-pole construction used in the farming sections and along highways.
C—Standard stub structure as finally decided upon for the two-pole towers. Stubs are 12-in.-square fir timbers, 15 ft. long and set in the ground 7 ft. There is a minimum penetration of half an inch and an absorption of 6 lb. of creosote per cubic foot. The estimated life of the stubs is from thirty to forty years.
D—Typical right-of-way.

fir stub 12 in. square and 15 ft. long. These were bought from a lumber company and put through the Rueping tank pressure-vacuum creosoting process, giving a minimum penetration of ½ in. and leaving in the wood 6 lb. or more of creosote per cubic foot. The method of attachment decided upon consisted of bolting the pole to the stub by ¾-in. x 30-in. galvanized bolts, spaced 6 ft. apart, and a lashing near the bolts of ten turns of No. 6 galvanized-iron wire drawn together to form a figure eight by a bolt passing between the stub and the pole, bent washers being used over the wires to prevent them from separating. The bolted and lashed attachment to the pole was found to give a strength equal to that of a treated pole in a direction parallel to the line, and greater than the required strength at right angles to the line for "heavy loading," i.e., wind velocity 57 miles per hour, or a pressure of 8 lb. per square foot on No. 00 conductors loaded with ½ in. of ice.

After the tests on the stubs were made the choice lay between a 12-in. x 12-in. x 15-ft. fir timber, a cedar stub 15 in. in diameter and 15 ft. long, and a fabricated galvanized-steel stub, all being of approximately equal strength. On a comparative cost basis the treated fir stub was found to cost only about one-half as much as the treated cedar stub and only about one-fifth as much as the steel stub. The comparative costs, f.o.b. point of railway delivery, follow:

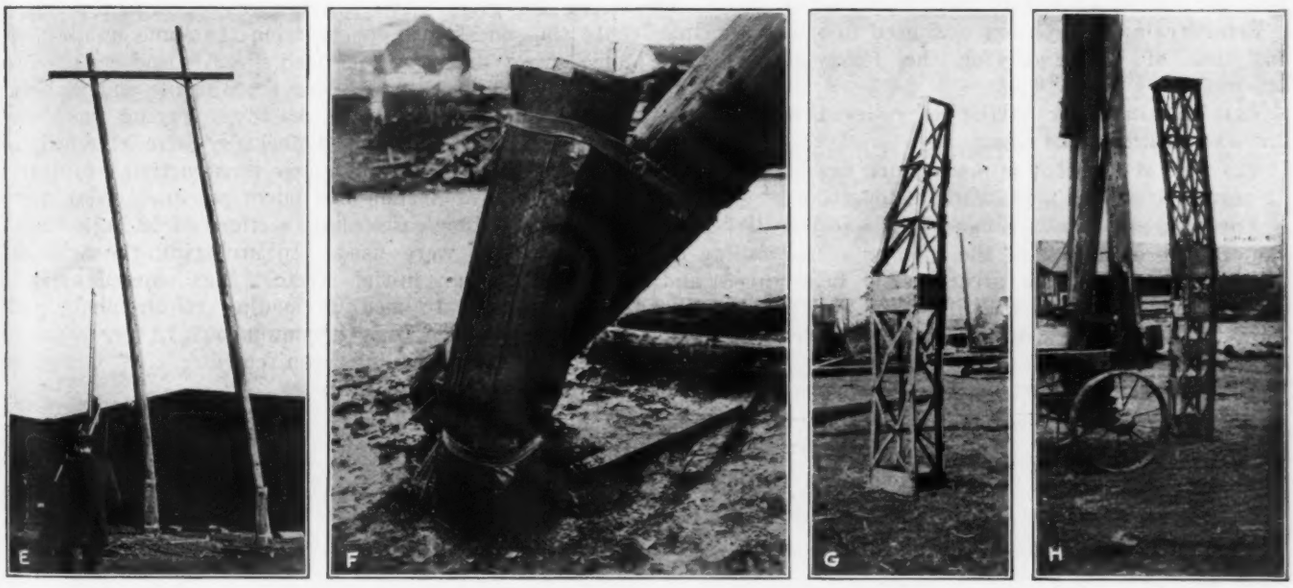
12-in. x 12-in. x 15-ft. tank-treated fir stub	$10.50
15-in. "pentrex"-treated cedar stub	19.20
Fabricated steel stub of equal strength (estimated)	50.00

The choice obviously lay between the fir and cedar stubs. The fir stub was chosen for the following reasons: (1) Fir is the stronger of the two timbers, (2) its cost when treated is less than that of a cedar stub of equivalent strength with butt treatment, (3) the pressure-tank treatment gives better penetration than the open-tank pole treatment and hence should give the stub a considerably longer life than that of the best treated cedar pole.

In regard to the probable life, A. F. Robinson, bridge engineer of the Santa Fé system, stated before a meeting of the Western Society of Engineers at Chicago in January, 1922, that "creosoted pine piling was in good condition after sixteen to twenty years of service and was probably good for twenty years more." In deciding on the stub a number of strength tests were made on various sized timbers of fir and cedar and on fabricated-steel stubs. Each was tested individually, and then a two-pole tower structure, the same as used on the line, was set up on stubs and tested to destruction. The steel stubs tested weighed about 400 lb. each and were shown to be much inferior in strength to the wooden stubs under consideration. It was estimated that a steel stub would have to weigh from 550 lb. to 600 lb. to have the required strength.

The line voltage chosen was 110 kv., principally on account of the load requirements. A higher voltage than 110 kv. was not deemed necessary, as it was thought probable that considerable time would elapse before the capacity of the line at this voltage would be exceeded, and when that time came another paralleling line might be built. The line at a voltage lower than 110 kv. would have too short a life in terms of capacity, and the cost per kilowatt would have been greater than for the higher voltage. The line at the present time is being operated at 66 kv., because at this voltage 8,000 kw. can be transmitted, and it is not likely that the demand on the line will exceed this for several years.

Suspension insulators were used for the present line voltage of 66 kv., instead of pin-type insulators, because it was definitely known at the start that a transmission voltage of 110 kv. would be necessary ultimately, and for this voltage pin-type insulators were out of the question. Furthermore, with the use of suspension insulators the additional cost of insulating the line for 110-kv. operation will be a minimum. The increased cost of building a line insulated for 66 kv., with suspension units spaced for 110-kv. oper-



TYPE OF LINE CONSTRUCTION DETERMINED BY TESTS

E—Tower with 2,250 lb. pull on end of cross-arm in test No. 5.
F—Test No. 3 was made on this fir stub, which broke at strain of 1,950 lb. at the top of a 50-ft. pole.
G—Fabricated-steel stub buckled in test No. 7.
H—Steel stub after being subjected to strain of 675 lb. at a radius of 50 ft. in test No. 8.

ation, was estimated to be 7 per cent more for the single construction and 10 per cent more for the two-pole tower construction than for 66-kv. pin-type construction. At the time the line is changed over to 110-kv. operation two more suspension insulator units will be added at the line end and it is estimated that at 110 kv. the line will have a normal capacity of 21,000 kilowatts.

General Features of Design

The line is sectionalized on an average every 12 miles with a three-pole, 110-kv. sectionalizing switch. The transmission line and the telephone line are transposed throughout the length of the line. Semi-strain anchor towers were placed approximately every mile in level country and oftener in the mountainous sections. Special semi-strain clamps were developed for this purpose, consisting of a standard heavy-body suspension clamp with special features to increase the holding power and 10-in. links to maintain clearance between insulators and conductors.

Semi-strain construction was used to stiffen the line in place of dead-ends for the following principal reasons:

(1) The insulator string is relieved of the continuous strain of the line.

(2) The attachment is much more flexible or elastic in regard to sudden application of longitudinal stresses.

These stresses may be caused by unequal sleet loading, failure of a part of the line, or a tree falling on the wires. Since the structure is head-guyed and back-guyed, dead-ends will allow the full force of the blow to build up suddenly against the tower and guys, while the semi-strain construction greatly relieves the shock by passing a part of it on to the next span and introduces a time element which reduces the peak of the strain. The inclined position of the insulator string also gives better weather protection to the disks.

In the semi-strain construction the same number of disks were used as for dead-ends. Dead-ends were used at the upper end of long steep spans and at both ends of the longest spans. All tower guying was done with ½-in. S. M. galvanized-steel guy wire attached to anchor logs. For the single-pole construction ⅜-in. guys were used. For anchor logs burnt seasoned cedar, yew logs, and in some cases short sections of 12-in. x 12-in. treated stubs, were used. In stringing the wire it first received an initial stretch, then sagged on the single-pole line to medium loading requirements and on the tower line to a tension about 12 per cent in excess of heavy loading requirements. All stringing was done with a dynamometer.

TABLE III—MATERIAL USED ON LINE

Length, miles	123
Wire, No. 00, copper, tons	410
Telephone wire, No. 6, "copperweld," tons	50
Insulators, 10-in. disks	23,000
Number of poles	2,250
Number of structures	1,331
Number of stubs	1,600
Number of dead-ends and semi-strains	266
Average span, single pole, ft.	342
Average span, two-pole towers, ft.	555
Longest span, ft.	1,702
Shortest span, ft.	120
Time of active construction, months	6
Maximum miles per day	2
Average miles per day	¾
Total number man-days	53,220
Man-days, per mile of line	433
Maximum number of men on the job	417
Maximum number of camps	9
Maximum number of survey parties	6
Number of men clearing, five crews	177
Number of men digging holes	48
Number of men stringing wire	58
Approximate number of ton-miles line material, railroad to line	40,000
Longest haul, railroad to line, miles	48

TABLE II—RESULTS OF TESTS ON STUBBED POLES

Test No.	Material and Size	Position of Stub	Fastening	Size and Pole Butt, In.	Distance Between Fastenings, In.	Pull (in Lb.) at Top of 50 Ft. Pole	Deflection Ft.	Deflection In.	Results
1	Round cedar, 12 in. dia., 15 ft. long. Single stub tested.	In line with pull	10 wraps No. 8BB iron wire.	18	41	1,000 1,300	7 11	7 6	Stub failed at slightly over 1,300 lb. pull by shearing lengthwise through center.
2	Square fir, 12 in. x 12 in. x 12 ft. Single stub tested.	In line with pull	12 wraps No. 8BB iron wire.	18	41	1,100 1,525 2,000 2,450	5 6 8	5 0 10	Top lashing broke.
3	Same as test No. 2.	Right angles to pull.	10 wraps No. 6BB iron wire.	18	46	500 1,000 1,950	10 17 31	10 9 0	Stub broke at bottom lashing.
4	Same as test No. 2, except that complete tower with two stubs was tested.	Pull from end of arm and at right angles to stubs.	10 wraps No. 6BB iron wire.	18	46	500 1,000 1,250	1 7 11	11 10 7	Cross-arm was placed on opposite side of poles from stubs and twisting was very noticeable, causing top lashing to loosen.
5	Same as test No. 4, except that cross-arm was placed on same side of poles as stubs.	Same as test No. 4	¾-in. through bolts, and 6 wraps No. 6 BB iron wire.	18	41	500 1,000 1,500 2,000 2,500	0 2 4 6 10	6 2 2 10 5	Test indicated that a wind pressure less than maximum would move pole tops too far out of line.
6	Round cedar stub, 15 in. in dia. and 15 ft. long.	Same as test No. 4	Same as test No. 5	17	41	1,000 2,500 3,500 3,700	1 6 9 10	5 1* 7 5	Could not hold 3,700 lb.; pull fell off to 3,100 lb. with increasing deflection. Pull of 3,400 lb. was then applied and one pole and one stub broke.
7	Single steel stub, 2½ in. x 2 in. x ⅜ in. corner angles. Horizontal girths, 1 in. x 1 in. angles. Side braces, 1½ in. x 1½ in. angles. Flat braces, ⅜ in. x 1½ in. Length of stub 11 ft. Set in ground 6 ft. Size base to ground line, 12 in. x 24 in. Weight, 400 lb.	In line with pull	10 wraps No. 6 BB iron wire.	15	41	550 625 750 975	Stub raked when set Stub plumb 5 11	 10 0†	The tests on the two steel stubs indicated that considerably heavier stubs, probably equal to the weight of the wood stubs, or 550 lb. to 600 lb., would be required.
8	Single steel stub 12 in. square, with bearing plates. Same size material as test No. 7. Weight, 380 lb.	In line with pull	10 wraps No. 6 BB iron wire.	15	41	500 640 675	2‡ 4 7	 5 7‖	

* No sign of failure. † All angles buckled. ‡ Flat braces bending. ‖ Could not hold over 675 lb., corner angles bending.

Drop-angle cross-arm braces were employed on all construction except where green fir poles were used. The fir in seasoning has a tendency to twist. On this account the braces were omitted wherever green fir poles were used, the arms in these cases being attached to the pole with galvanized U-bolts. On double-arm construction a through bolt was placed on each side of the pole, thus giving the pole freedom to twist.

In all, 44 miles of right-of-way through timbered areas was cleared to a width of 50 ft., and all dangerous trees, including those which were leaning or partly decayed, beyond this width which could reach the line were removed.

The amounts of material given in the following tabulation include spare material left every mile for the greater portion of the line for emergency repairs. This material included 200 ft. No. 00 copper wire, 200 ft. No. 6 telephone wire, one high-tension arm, one telephone arm and one stub.

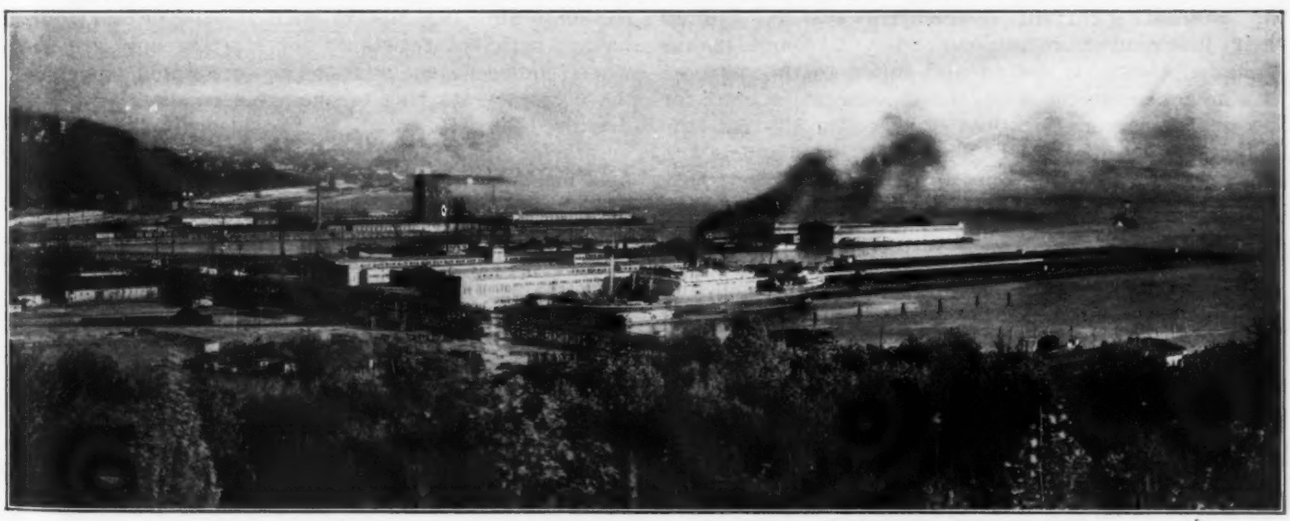
The survey was started on March 9, 1922, and completed on July 7, 1922. The first holes were dug on April 10, 1922, and the last on Oct. 2, 1922. The first wire was strung on May 9, 1922, and completed on Oct. 12, 1922. The surveying started with two crews, and later others were added until there were six separate surveying parties at different points in the field. Following the surveyors came the clearing gangs, then the hole diggers, then the distributors of material, later the tower erecting crews, and the wire stringing crew last. Powder was used in digging all holes. The towers were framed on the ground and erected with line and shears. Much of the material had to be hauled along the right-of-way, some of it for distances up to 5 miles. During the busiest season nine camps were maintained. There were on the average twenty auto trucks in use on the job. The line was completed on Oct. 15 and placed in operation on Oct. 23; over half a mile of line was completed per day over the entire period of time on an average.

Electrification of Seattle Port Terminals

Factors Influencing the Undertaking and Requirements of Electrical Equipment to Meet Port Needs—Essential Features of Lighting and Power Distribution

By O. P. SEIM*

Superintendent of Distribution Puget Sound Power & Light Company



THE SMITH'S COVE TERMINAL OF THE PORT OF SEATTLE IS AN EXCELLENT EXAMPLE OF UP-TO-DATE TERMINAL ELECTRIFICATION

ELECTRIFICATION of a port terminal is dependent upon such factors as lower handling charges, flexibility of operation and the speed attained in handling cargoes. The port of Seattle in adopting a policy of electrification of its terminals was primarily actuated by these factors as well as by the necessity for providing facilities for handling great volumes of commerce in commodities of all varieties, both in bulk and in packages. The coordination of railway and marine transportation lines near available industrial sites, in order that these areas might become centers of industry, entering into the original studies of the electrification of the port terminals, exerted a determining influence upon the selection of the terminal sites. Additional factors were the uncertain degree to which the commerce of the port would expand, the character of the cargo-handling equipment of the ships likely to use the terminals, and the nature of the cargo of these ships.

The Smith's Cove Terminal, the most recent and modern in the port of Seattle, has been laid out according to the best practice in port electrification and may be said to be a model terminal of its kind. In designing the electrical installation for this terminal it was found that power requirements fell into two major classifications, as follows:

*Formerly mechanical engineer port of Seattle.

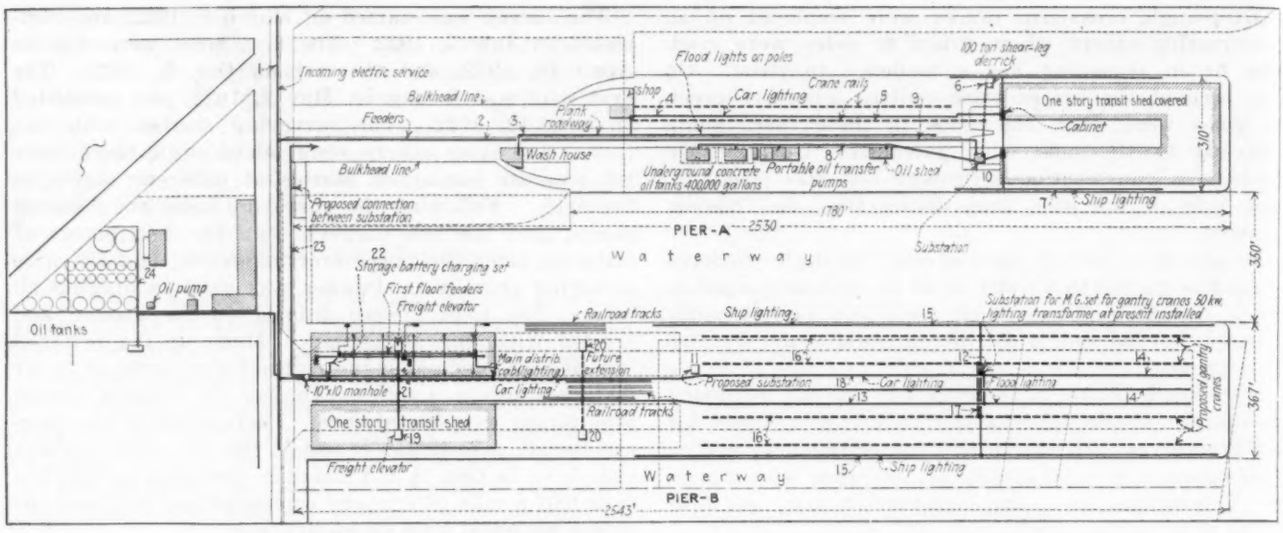


FIG. 1—GENERAL LAYOUT OF PIERS, WITH LOCATION OF EQUIPMENT AND SHEDS

A. Power for driving machines, either in groups or individually, at constant speed. This applies most commonly to conveyors, pumps, elevators and motor-generator sets.

B. Power for driving machinery where it is desirable to obtain speed variation between less than 50 to 100 per cent of maximum. All power in this class is obtained from motor-generator sets. The use of motor-generators instead of rotary converters for this class of service is favored by the port engineers because it is desirable to correct for low power factor on the alternating-current distribution system, and in their judgment a rotary converter, although it has higher efficiency, is not so well suited to this purpose as a motor-generator set. Direct current is used for the gantry crane, the 100-ton shear-leg derrick, the 25-ton stiff-leg derrick, the electric lifting magnets and for charging of tractor storage batteries.

For the requirements of motors under class A, voltages of 440 and 2,200 are used, 440 volts being the most extensively employed. Equipment rated at 220 volts is not desirable owing to the larger size of conductors and conduit required. A 2,200-volt circuit is used only in the case of driving a 300-kw. motor-generator set.

The table gives the electrical and mechanical data for the electrical equipment at the Smith's Cove Terminal, piers A and B. In case it should prove necessary or desirable to generate alternating current, especially for terminal requirements, it is the opinion of the port engineers that load factors ranging from 70 to 75 per cent should be employed, rather from 80 to 85 per cent, which is considered good practice in the design of central stations. This is because of the large proportion of induction-motor load and the consequent low power factor. For equipment operating at constant speed, where conditions would permit, induction motors are used and controlled by standard forms of starting switches, equipped with low-voltage and overload protection. Slip-ring motors with drum-type controllers having sufficient resistance for starting only are used where squirrel-cage induction motors would not supply the necessary starting torque. Where slip-ring motors are used an oil switch is provided in the primary or starter circuit of the motor. If the requirements of a machine are such that motor speeds varying from 50 per cent of maximum to maximum are necessary, a slip-ring induction motor is used with drum-type controller and resistance banks in the secondary or rotor circuit of sufficient capacity to permit of continuous operation at any point of the controller. In those cases where speed variation between less than 50 per cent of maximum and maximum speed are required for driving a machine direct current is used. No standard has been adopted for the control of such

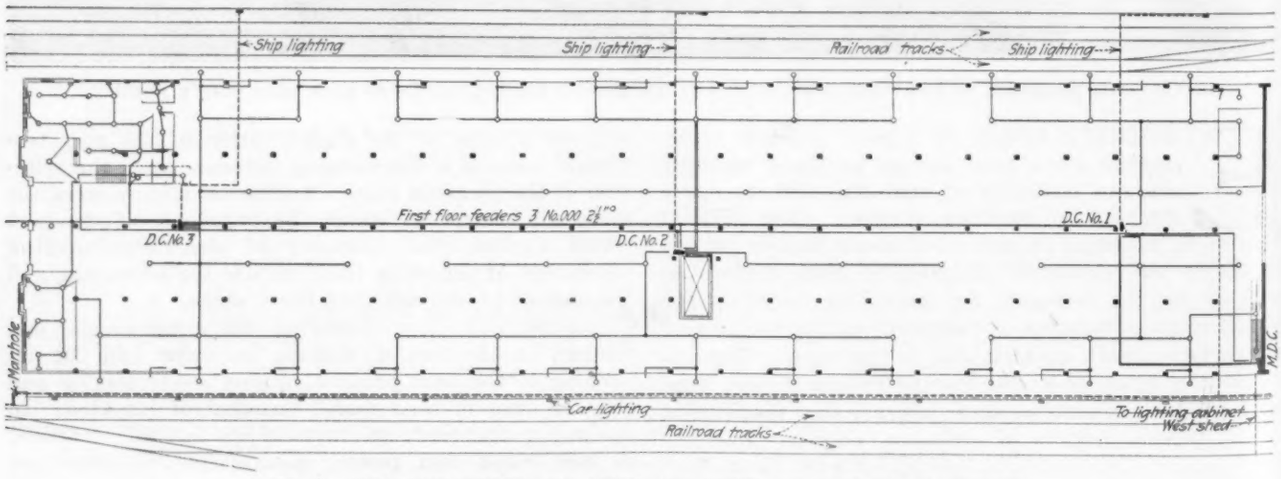


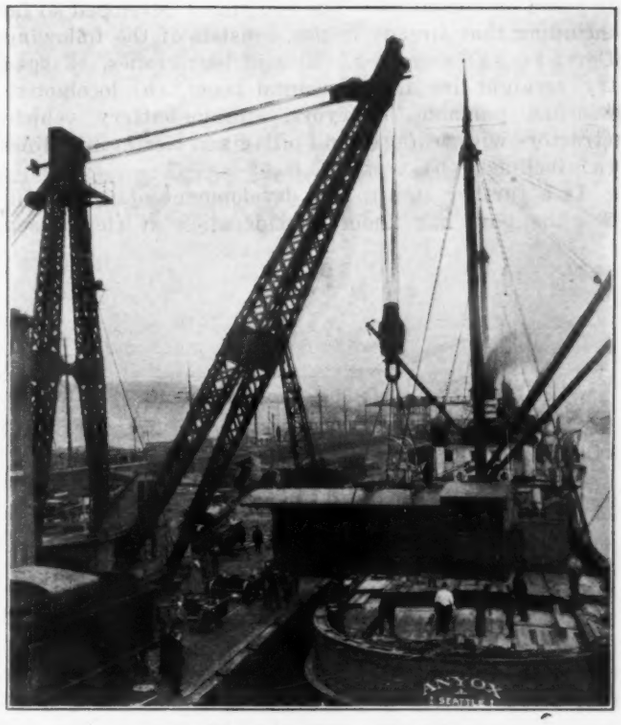
FIG. 2—ADEQUATE OUTLETS FOR LIGHT AND POWER AID MATERIAL HANDLING

motors. Instead, the control is designed to fit the needs of the particular case, and it may vary from a standard plate-field rheostat to the more complex contactor panels.

Service is supplied by the city of Seattle over two circuits, one of 7,500 volts and one of 15,000 volts, to the substations on the terminal property. Fig. 1 shows the location of electrical equipment and substations on piers A and B and the general arrangement of lighting and power circuits. In the case of pier B, which is the latest to be constructed, a 440-volt, three-phase power circuit runs the full length of the pier and is fed from a transformer station situated about the center of the pier. This arrangement has resulted in a more economical installation owing to the reduction in the size of the feeder and conduit made possible in the 2,600-ft. run as compared with that which would have been required had the transformers been installed at one end of the circuit. The three 50-kva. transformers supplying this feeder are operated from a 2,300-volt circuit.

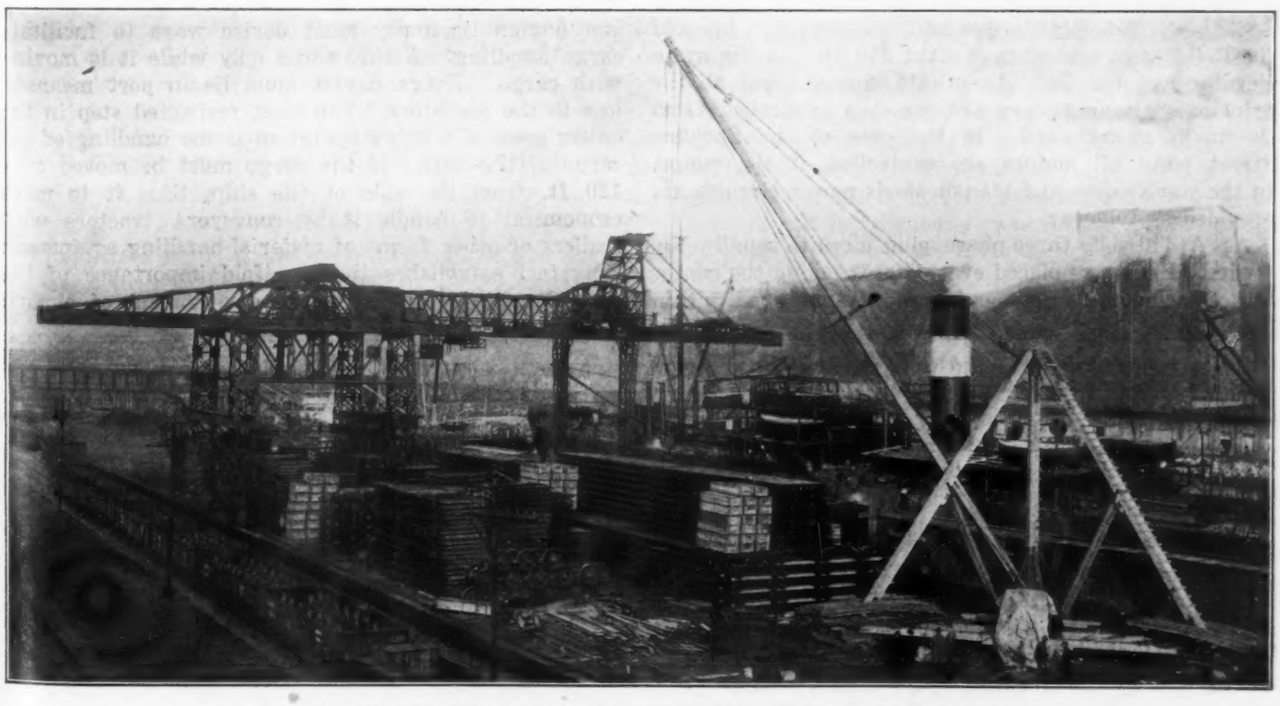
Fig. 2 shows the lighting circuits in the warehouse and transit shed on pier B, as well as the power-plug receptacles for portable motors. The lighting circuits consist of a main and a night circuit. The main circuit is used when cargoes are being handled or when illumination of high intensity is required. The night circuit is used at all times when only enough illumination to allow a clear view of the contents of the warehouse and transit shed is necessary. The tendency toward the use of conveyors, stackers, tractors and other material-handling equipment makes this arrangement of lighting circuits most economical.

Lighting circuits on the open dock consist of a car-lighting circuit, a ship-lighting circuit and a floodlighting circuit. The car-lighting circuit is a plug circuit installed on the side of the transit shed and is used for illuminating box cars or refrigerator cars while they are being loaded or unloaded. The ship-lighting circuit is a plug circuit installed near and parallel to the bull-rail of the dock. The lighting circuit of the ship is connected to this circuit with portable cord, in order that the ship may shut down its boilers and engines for cleaning and repairs. The floodlighting circuit is used to illuminate the dock in the proximity of the ships that are moored there.



CRANES DO THE HEAVY WORK

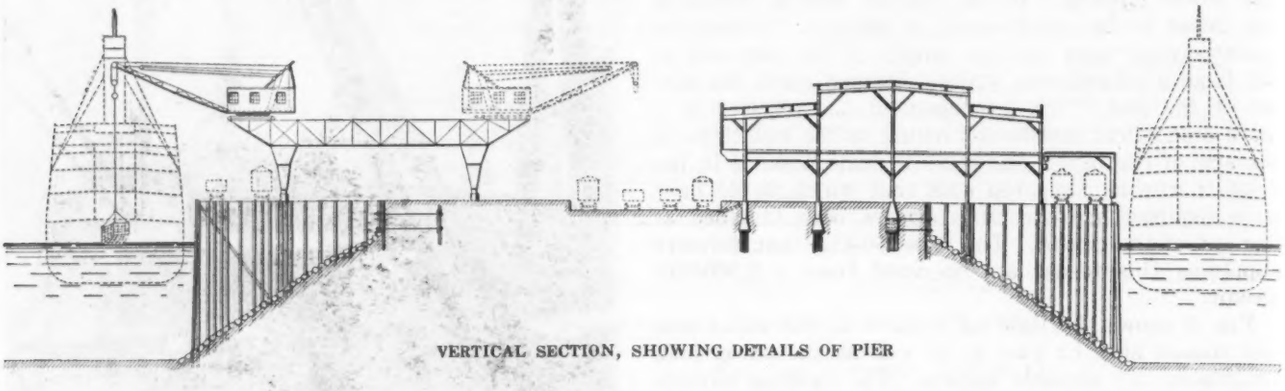
Owing to the extremely limited field of choice in conveyor equipment applicable to the broad field of use embraced in handling the numerous and varied cargoes that come to the port of Seattle, the design of special equipment has been undertaken to meet the demands



SPECIAL CARE WAS GIVEN TO SECURE RAPID LOADING AND UNLOADING OF VESSELS

imposed by commerce. The equipment developed so far, including that already in use, consists of the following: Derricks, (a) shear leg, (b) stiff leg; cranes, (a) gantry, straight-line and horizontal boom, (b) locomotive; winches, portable conveyors, storage-battery vehicles (tractors with trailers) and piling and tiering machines, (a) inclined, (b) vertical.

As a further step in the development of port facilities the port has under consideration at the present time the installation of an electrically driven air compressor of sufficient capacity to allow certain repairs to be contracted for and executed at the pier while a ship is handling its cargo, rather than having it laid up at a repair yard for several days in addition to the time spent in discharging and loading.



VERTICAL SECTION, SHOWING DETAILS OF PIER

The port of Seattle has three principal industrial terminals, all of which are completely electrified. They are the Hanford Street terminal, at which is constructed and in operation a 1,200,000-bushel grain elevator; the Spokane Street terminal, at which is a 900-carload fruit-storage plant, a 100-ton ice plant, a fish-freezing plant of 300,000 lb. capacity per day, a fish storage plant of 3,000,000 lb. capacity and ice storage for 5,000 tons, and the Bell Street terminal, at which there is a 90-carload miscellaneous cold-storage space.

The grain elevator has 900 hp. connected load, the Spokane Street cold-storage and ice plant 600 hp. and the Bell Street cold-storage plant 250 hp. In the grain elevator and the Bell Street cold-storage plant all the principal driving motors are remotely controlled from the main switchboard. In the case of the Spokane Street plant all motors are controlled at the motor. In the warehouses and transit sheds power circuits are provided as follows:

A. A 440-volt, three-phase plug circuit, usually No. 4 wire. Plugs are placed every 100 ft. along the center line of each floor of the warehouse or transit shed, within reach of the machine operator. This circuit is intended for the use of conveyors, stackers and other portable equipment.

B. Freight-elevator circuit.

C. A 440-volt, three-phase circuit to take care of the motor-generator set for a constant-potential charging set used for charging tractor storage batteries. A typical 30-kw. set consists of a 75-volt, 400 amp. commutating-pole, shunt-wound, direct-current generator, direct connected to a 50-hp., three-phase, 440-volt, 60-cycle, 1,200-r.p.m. induction motor, with starting compensator. On a switchboard are mounted a voltmeter, a shunt ammeter, an overload circuit breaker, a shunt-field rheostat, a voltage regulator and a 600-amp. main switch. This set has capacity for charging at the same time six tractors having twenty-four "Exide" cells each.

On the open dock great care has been taken in making the distribution system flexible. Although the equipment of a pier may be fairly well predetermined and the circuits provided, new business may require alterations or additional equipment, thereby necessitating changes in the distribution system.

The paramount function of a port terminal is to allow a ship to enter, discharge and load cargo and get away with as little confusion and delay as possible. To this end human ingenuity must devise ways to facilitate cargo handling. A ship earns only while it is moving with cargo. Every day it must lie in port means a loss to the operators. The most restricted step in the entire cycle of a ship's operation is the handling of the cargo at the port. If the cargo must be moved over 120 ft. from the side of the ship, then it is more economical to handle it by conveyors, tractors with trailers or other forms of material-handling equipment. This fact establishes the manifold importance of the cargo-handling problem in the development of a port.

ELECTRICAL AND MECHANICAL DATA ON MOTIVE EQUIPMENT AT SMITH'S COVE TERMINAL OF THE PORT OF SEATTLE

Type of Equipment	Hp.	Voltage	Speed, R.P.M.	A.C. or D.C.	Type of Motor	Type of Drive	Type of Control
Gantry crane:							
Hoist	25	220	510	D.C.	Series, crane type	.....	Remote control from cab
Travel	125	250	490	D.C.	Series, crane type	.....	Remote control from cab
Crane apron	40	220	450	D.C.	Series, crane type	.....	Remote control from cab
Trolley motor	18	220	510	D.C.	Series, crane type	.....	Remote control from cab
100-ton Shear-leg derrick	85	230	430	D.C.	Series	Gear coupled to hoist drum	Railway type reversing drum controller
Portable oil transfer pumps	10	440	1,200	A.C.	Induction, constant speed	Gear coupled	Standard control
Substation motor generator set	450	2,500	.....	A.C.	Synchronous	Direct-connected	Standard control
Freight elevators, capacity 20,000 lb., 60 cycles per minute	50	440	720	A.C.	Wound rotor	Worm-driven gear	Standard elevator control
Oil booster pump	10	440	1,200	A.C.	Induction, constant speed	Geared	Standard control
Portable motive equipment	5	440	.....	A.C.	Induction, constant speed	.....	Standard control
Tractor battery charging set:							
Motor	50	440	1,200	A.C.	Induction, constant speed	Direct-connected to generator	Standard control
	K.W.						
Generator	35	75	1,200	D.C.	Shunt-wound, commutating pole	Direct-connected to motor	.....

Another Word to Utility Stock Salesmen

Ancient and Accepted Methods of Investing Money and the Peculiar Advantages of Public Utility Securities, Being Some Reflections and Observations, but Containing, However, No Advice or Recommendation

By WARREN R. VOORHIS

THERE are three orthodox methods of selecting an investment for your money.

Named in the order of their popularity, they are:

1. You may trust your money to a stranger, a gentleman from foreign parts, who has the quick intelligence to recognize at a glance your great capacity to grasp an opportunity before it is too late, and who, also, by reason of your well-known standing and dominating influence in the community, is frequently able to make very attractive promises of really remarkable returns.

2. You may select from your acquaintances that man in whose judgment and financial ability you have the most confidence, give your money to him to invest for you, and thus be done with the whole tiresome business.

3. By observation and study you may acquaint yourself with the simple rules governing the investment of money and then select your investment after such study and observation.

In my time I have employed each of these methods and found that each possesses distinct advantages.

Now, I will here set forth my reflections concerning these three ways of choosing an investment for savings.

The loose, superficial thinker might argue that since 90 per cent of all money invested according to the first method is forever lost to the investor, this method is to be condemned.

A moment of serious reflection exposes the fallacy of this gloomy view.

It is based upon the assumption that the only compensations in life are financial.

One must admit that the rewards to be received from the use of this first method must be expressed other than in terms of money, but it by no means follows that rewards do not exist.

Trusting the Stranger

For example: It is always a distinct and gratifying pleasure to me to meet an intelligent stranger, especially one who is able instantly to discern my own intelligence and capacity, particularly in financial matters.

We all feel ourselves to be surrounded by rather dull people, especially relatives, who do not justly appreciate our talents.

To have our true worth appraised by a stranger, who is, of course, wholly disinterested, is one compensation for the use of the first method of investing money.

Then there is a world of romance and imagination in this method, and what sort of a world would this be without romance and imagination?

To feel that you are really a part owner in, say, a cocoanut plantation, located somewhere on an island in the South Seas, where the cocoanuts drop to the ground from the trees, or brushes, or vines, or whatever it is they drop from, and where happy skin-clad natives pitch them into my ships which have anchors and "bo'suns" and "mains'ls" and everything, all this gives an uplift to my spirit and I do not know how to say what it is worth in money.

The picture is always so interesting and attractive to me that it hardly needs the statement of the agent that the stock will be doubled in price within the next thirty days to make me come in.

So that, while I have always lost all the money I ever invested according to this first method of choosing an investment, I am by no means prepared to say that the method possesses no advantages whatever.

I only mean to say that now that I am older and colder I am a little more inclined to separate my romance and imagination from my pocketbook and a little less inclined to estrange myself permanently from my money.

Now, when a fascinating stranger tells me, with his hand on my knee, that I have a great head for finance, I at once admit this and offer it as a reason why I am able to attend to my own financial business, and I point out to him how wrong it would be for me to detain him when so many less able gentlemen are doubtless eager to take his counsel.

Leaning on a Friend

The second method of choosing an investment has one tremendous advantage.

It makes a minimum demand upon the brain of the investor.

You turn your money over to an honest friend for him to invest according to his judgment, and go your way.

Probably nothing could be more simple than this.

The profound antipathy of the human mind to any form of connected thought is our richest heritage from the arboreal period of civilization.

This method has a further advantage.

Your friend is frequently honest and capable and a good deal of money so invested is well and safely placed.

When it turns out otherwise, you have had the great comfort of having been free from responsibility, and you have also the privilege of calling upon high heaven to witness the perfidy of your friend.

I myself have tried the second method quite often.

Maybe I will again turn over my money to a friend for investment.

But never, never so long as I live, will I take from a friend his money for investment.

When the investment turns out well, my friend proclaims abroad the soundness of his judgment in choosing his investment.

When it turns out badly, my former friend ever afterward regards me with a gloomy and accusing eye.

He wonders what he ever saw in me to warrant his confidence.

This is the reason that I am giving no advice in this article.

I suppose it might be suggested as an objection to this method that one who always relies upon the judgment of others will never become very self-reliant and will never learn to think for himself.

It is only fair to reserve judgment upon this objection until it is demonstrated that the people who think are happier than those who do not think.

I have many friends among both classes, and I am not prepared to give a final opinion.

A THREE-QUESTION ANALYSES

The third method of choosing an investment is only popular with those persons who have formed a deep attachment for their money and a firm intention not to be separated from it.

I observe that nearly every sound competence and provision for old age has been invested and accumulated according to this method.

Some very able gentlemen make fortunes by keeping alive the hoary tradition that the investment of money is a subject too deep and difficult for people who have only brains enough to make and save money.

But if any man with a little money to invest will first ask three pointed questions, and if he will keep his money in his fist until he gets a satisfactory answer, he will save himself some grief, and the executor of his estate will be required to give a larger bond. These three questions are:

"Will my money be safe?"

"Will my return be as high as is consistent with safety?"

"Can I get my money back when I want it?"

Of course, it would be unsportsmanlike to ask such questions of the picturesque blue-sky salesmen, where, as I have pointed out, romance and adventure rather than stability and safety are the rewards to be expected.

But try these questions upon some of the standard forms of investment and you get interesting results.

APPLYING THE TEST

Real Estate.—If you use good judgment in the choice of location, your money ought to be safe. If you can keep the property occupied, if your tenants pay their rent, if taxes and assessments and insurance and repairs don't eat you up, and if you did not pay too much for the property, you ought to make a fair return.

If you can find some one who wishes to invest in real estate, and if he likes your property, and if he will pay you as much as or more than you paid, you should have no trouble in getting back your capital.

It will pay to ask these three questions before you buy any real estate.

Business.—You can easily put your money in business. If you select a good business, one which gives a service or makes a product which people want badly enough to be willing to pay more than the cost, your money should be reasonably safe. If you have sense and experience enough to run the business, or if you can find and keep a man with sufficient brains and honesty to do it for you; if times are good; if you are not too much bedeviled by strikes, storm, fire, earthquake or bad debts, you should get a fair return. And when you want to quit, as you may, if you can find some man who wants to go into business, and who likes your line of business and who will pay you as much as or more than you paid for it, you should have no trouble in getting out whole.

These three questions will help you to decide about going into business.

Government Securities.—They are safe. The faith and credit of the richest country on earth are behind them. They are safe.

Because they are safe as minted gold held in your hand, the return is low, lower than any other form of investment. The entire absence of risk is paid for by a very low return. The market for these securities always exists. If you want your money, you can get it.

Public Utility Securities.—They are very safe. These utility companies furnishing light, water, power, heat, communication, transportation, give to all the people, all the time, a service so necessary that we cannot think of modern life without them. In peace or in war, in good times and bad times, we must have this service.

They earn moderately, but constantly. By the law of the land they are permitted under public regulation to earn a fair, reasonable return upon their fair value.

Because the service of utilities is essential to the very life of the country, because they grow as the country grows in population and wealth, because the return is constant and reasonable, because economy and efficiency are assisted by public observation and supervision, the sound securities of these corporations have become a form of investment favored by an increasing number of investors. This makes a wide market.

The three questions should be of service in selecting a public utility security for investment.

But really there is nothing new about the form or substance of these questions.

They are invariably asked by every investor, no matter what method of selection he employs.

My point is that they will be found to be more useful if they are asked and answered before, rather than after, the investment is made.

WHEN WINTER COMES

Too late, after I have taken the trouble to set down these reflections, it occurs to me that, after all, there are very few people interested in the subject of investment according to any method.

Perhaps it is part of the privilege of the salesman who is endeavoring to sell utility securities to men and women of the community that the company serves to bring these questions to the attention of investors.

For most of us travel gayly through life, considering every dollar saved as so much excess baggage.

We lean heavily on that beautiful Biblical text: "Consider the lilies of the field, how they grow; they toil not, neither do they spin, yet Solomon in all his glory was not arrayed like one of these."

This argument appeals most forcibly to me in June when the lily proudly bends her lovely head to the soft summer wind.

In October, when the early frosts have turned her petals brown, and in December, when she stands stripped and shivering in the bitter winter wind, I am inclined to doubt whether this text was even intended as a guide to thrift and investment.

And as for King Solomon, I think the record is fairly clear that one of his acts of wisdom was to collect and keep enough gold and gear by him to last through the winter of his years.

These are my reflections upon the ancient and accepted methods of investing money.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Compound Migration Inappreciable in Modern Cables

To the Editors of the ELECTRICAL WORLD:

Impregnated paper cables were formerly made with thick compounds and loose paper. When the compound melted under the influence of load in the cable it ran down in the large spaces between the paper tapes wherever there was a vertical run. This resulted in leaving voids which ionized at high voltages and caused failures. Modern cables are made with tight paper and comparatively thin compounds. When the compound melts most of it is held between the tapes by surface tension.

Tests which were made in 1922 on a cable of modern type consisted in suspending a 15-in. length at an angle of 45 deg. in an oven, both ends of the cable being open. The oven temperature was 220 deg. F., and the cable was kept at this temperature for ninety-six hours. Upon cooling, the cable was subjected to a high-voltage test. It withstood 150-kv. alternating current for one hour without showing any signs of distress. The cable was of 350,000-circ.mil cross-section and had $\frac{11}{64}$-in. insulation on each conductor and a belt of $\frac{7}{64}$-in. thickness.

WILLIAM A. DEL MAR,
Habirshaw Electric Cable Company, Inc., Chief Engineer.
Yonkers, N. Y.

Meshed Networks for Alternating-Current Distribution

[The editors of the ELECTRICAL WORLD requested Mr. Torchio to submit comments on M. T. Crawford's paper, "Merits of Alternating-Current Underground Distribution," published in the issue of Dec. 23, and he sent in the following.]

To the Editors of the ELECTRICAL WORLD:

The low-tension alternating-current systems of distribution are at present generally founded on the fundamental principle of subdividing the territory to be served into separate districts and feeding each district from an independent feeder. Within each feeder district the secondary mains fed by step-down transformers are sometimes connected in a meshed network, but more often they cover only isolated portions of streets in the district, each fed from an individual step-down transformer. Gradually, as the primary feeders become fully loaded, the original districts are subdivided and additional districts created to be fed by corresponding new primary feeders. This fundamental method of growth of low-tension alternating-current systems of distribution, while eminently satisfactory in scattered districts, entails many handicaps when applied in congested and heavily loaded city districts. For such conditions some arrangement of a single meshed network of mains fed from all feeders in the same manner followed in direct-current three-wire systems would afford very great advantages. This has prompted engineers to make efforts to build up low-tension alternating-current meshed networks of distribution.

M. T. Crawford's paper gives a description of one such development. One prominent feature is the fact that Mr. Crawford has solved the difficult problem by the combination of standard apparatus, each unit being already fully developed and obtainable from the standard production of manufacturers. As the district served by the Edison system in Seattle furnishes less than 10 per cent of the total company's service, the advantages that a direct-current system might have would be relatively insignificant as affecting the total business. The adoption of this new system to provide for the growth within the district, still retaining the direct-current system for special customers requiring such service, is probably a compromise prompted by the desire on the one hand to retain the existing investment and on the other hand to obtain a unification of the system, which would offer obvious economical advantages.

PHILIP TORCHIO,
New York Edison Company, Chief Electrical Engineer.
New York.

Pyro-Electric Theory of Insulation Failure

To the Editors of the ELECTRICAL WORLD:

I have read with great interest the discussion by Dr. Whitehead and Mr. Fechheimer in the Nov. 11 issue of the ELECTRICAL WORLD, and by Mr. Del Mar in the Dec. 9 issue, of the article of Oct. 21 contributed by me in collaboration with Dr. Steinmetz on "The Pyro-Electric Theory of the Breakdown of Solid Insulation." We stated in this article that our theory had been gradually developed as the result of our investigation of insulating materials for some years, and we were very much pleased during Dr. Wagner's visit to our country, when comparing notes with him, to find that he had independently come to the same conclusions.

The results of the work since the publication of the article have given further evidence in favor of the theory.

We do not mean to claim that with alternating voltages the pyro-electric effect is caused entirely by the ohmic resistance of the insulation, but the effective resistance of dielectric hysteresis (whatever that may be) may play a large part. Indeed, in a number of our tests the amount of energy loss produced by the ohmic resistance of the dielectric, as measured by high-voltage direct current, was only a very small part of the total energy loss observed under alternating voltage.

In our article we used widely different materials to illustrate the wide extent over which we observed this pyro-electric effect, but no special conclusions can be drawn from the particular nature of the material used in each case, whether Nernst lamp glower or paper, etc. For instance, the black varnished cloth commonly used as machine insulation gave us the same characteristic as the Nernst lamp glower, and mica the same characteristic as unimpregnated paper, so that the described characteristics are not special to the Nernst lamp glower or the paper, but are more general. We are preparing a more extensive paper on the subject for the American Institute of Electrical Engineers.

The difference between our conclusions and those of Dr. Wagner on the variations of the disruptive voltage with the thickness of the insulation is only apparent. Dr. Wagner shows mathematically that if a hot spot in the insulation conducts heat only tangentially into the insulation, then the disruptive voltage should be proportional to the thickness of the dielectric. In his experiment he used wooden blocks as terminals, which were poor heat conductors, and so his assumption was justified. If, however, a sheet of insulation is tested

between metal terminals, which are good heat conductors, then a considerable part of the heat of a hot spot is conducted transversely to the terminals. Indeed, with a thin laminated dielectric practically all the heat may have to be conducted to the metal terminals. It can be shown that in this case the disruptive voltage is not proportional to the thickness of the dielectric, but to the square root of the thickness of the dielectric. In general, therefore, the breakdown voltage of sheet insulation should increase somewhere between proportionality with the thickness and proportionality with the square root of the thickness of the insulation, depending on the proportion of the heat conducted tangentially and radially. The law of variation of breakdown voltage with the thickness, therefore, cannot decide the question whether the effect is pyro-electric or not.

J. L. R. HAYDEN.

Schenectady, N. Y.

Dielectric Loss and Breakdown

To the Editors of the ELECTRICAL WORLD:

In his discussion in the Nov. 11 issue of the ELECTRICAL WORLD of the article by Mr. Hayden and myself in the Oct. 21 issue Dr. Whitehead refers to the characteristic of many insulators, that when a constant voltage is impressed upon them the charging current does not die out rapidly, as required in a circuit with fixed constants, but decreases slowly, sometimes over a period of minutes.

None of the various ingenious explanations given for this characteristic—the motion of water in capillary fibers, progressive ionization, etc.—is satisfactory, when it is remembered that this phenomenon is shown to a marked degree by glass, mica and other materials. I have therefore attacked the question mathematically, in studying the transients in a condenser of non-homogeneous dielectric, such as a cable, but with fixed constants.

Suppose the dielectric of a condenser is laminated—that is, consists of alternating layers of different specific capacities and different resistivities—and a constant voltage e_0 is impressed upon it over a supply circuit of resistance and inductance. The charging transient then consists of three terms—not two terms, as in a condenser with homogeneous dielectric.

Two of these terms are of very short duration and may combine to form an oscillation. They are due to the constants of the external or supply circuit and usually have passed in a fraction of a second, leaving the condenser charged to terminal voltage e_0, but with the voltage distributed between the two materials in proportion to their elastances (reciprocals of capacity). The third transient, however, is of very long duration, commonly many thousand times slower, and has not yet apparently started when the other two have vanished. By the third transient, which I may call the "internal transient" in distinction from the "external" double transient, the internal voltage distribution between the two materials changes from that corresponding to their respective elastances to that corresponding to their respective resistances. Considerable energy is supplied by the external circuit during this transient—which lasts for minutes—to the interior of the dielectric, and of this energy half is dissipated as heat in the resistance of the dielectric, the other half stored as internal electric charges between the layers.

If, then, the supply voltage is withdrawn and the condenser terminals discharged by a momentary short circuit, the terminal voltage of the condenser gradually builds up again from zero to a maximum value of "residual charge" and then gradually dies down.

In this no variation of constants is assumed, no mechanical changes or local oscillation, but the results are derived for the circuit system of entirely fixed constants.

As illustration, a high-voltage cable of 1,300 ft. of about 0.74 mf. capacity, charged with 20,000 volts direct, over a kenotron rectifier from a 2.5-kw. transformer, gives the charging transient:

$$i = 0.108 \times 10^{-3} + 0.264 \times 10^{-3}\ \epsilon^{-0.0091t} + \epsilon^{-82.5}\ (3.2 \sin 196t - 0.372 \times 10^{-3} \cos 196t)$$

One hundred and fifty-four watts is stored as condenser charge during the first quarter second by the external transient, and an additional 288 watts is stored during the next half hour, as internal charge between laminations, by the internal transient.

Discharging the cable by a momentary short circuit, its voltage gradually builds up again from zero to 9,250 volts residual after one and one-half minutes, and then gradually vanishes.

I have specifically considered the case where the lack of homogeneity is due to laminated structure, partly because this is the most important case in cables and condensers, and partly because it is mathematically the simplest. Obviously, similar very slow transients must appear for the same reason, the formation of internal charges between materials of different characteristics in structure with other forms of heterogeneity.

I am preparing an Institute paper on this subject.

CHARLES P. STEINMETZ.

Schenectady, N. Y.

Proper Methods of Fusing

To the Editors of the ELECTRICAL WORLD:

Here are a few suggestions on the much-discussed subject of fusing the grounded side of branch circuits. My judgment is that the neutral or grounded wire should be continuous from transformers to lamp sockets or apparatus, except where provision is made for opening simultaneously every wire of the circuit, as at switches or attachment plugs. The wire should taper in size as it does in wiring where fuses are used, but all fuses on the grounded wire should be eliminated.

The greatest objection to this practice that seems to have been offered is that there would be but one fuse protecting the circuit, while under the present practice there are two. This objection may be simply and completely met by inserting two fuses in series at the branching point in the hot wire. It would be inexpensive compared with the safety gained to add even more than one fuse in series. The fuses, if placed in series on the hot wire, may include only one of the proper size, the others being slightly larger, so that all will not easily blow when ordinary trouble occurs, while at the same time a measure of safety will exist in case the right-sized fuse is bridged.

The most prevalent method of bridging fuses is with coins. This practice can easily be overcome in the design of the block. Overfusing should be prevented by designing the block so that plugs of different sizes are not interchangeable, and there should be fewer sizes made.

FRED CLAYTON,
Chief Electrician.

Gulf Lumber Company,
Fullerton, La.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Carrier Current Being Used Successfully

AS SOON as the development of the carrier-current telephone system had reached the point where apparatus was available the Utica (N. Y.) Gas & Electric Company obtained two sets which were placed in regular service and from which very satisfactory results have been obtained. The apparatus was tuned in, tested out and turned over to this company for regular service on Dec. 8, 1922. During the first two or three days of operation a very few minor troubles were experienced. These were immediately corrected by engineers of the General Electric Company, and since that time the carrier-current telephones have been in regular and continuous use without any further trouble. The two sets now in service are rated at 50 watts and transmit 12½ miles over a 44,000-volt transmission line.

The operation of the sets is almost as simple as with the ordinary telephone. Taking the receiver off the hook starts the motor-generator set and puts the apparatus into condition for either talking or receiving. There is a small key, similar to the key on a telephone switchboard, mounted on the telephone transmitter stand. When this key is pushed up a calling signal is sent to the other station. The key is then released, leaving the telephone in condition for receiving. When the operator desires to talk he pushes the key to the talking position, then releases it for listening.

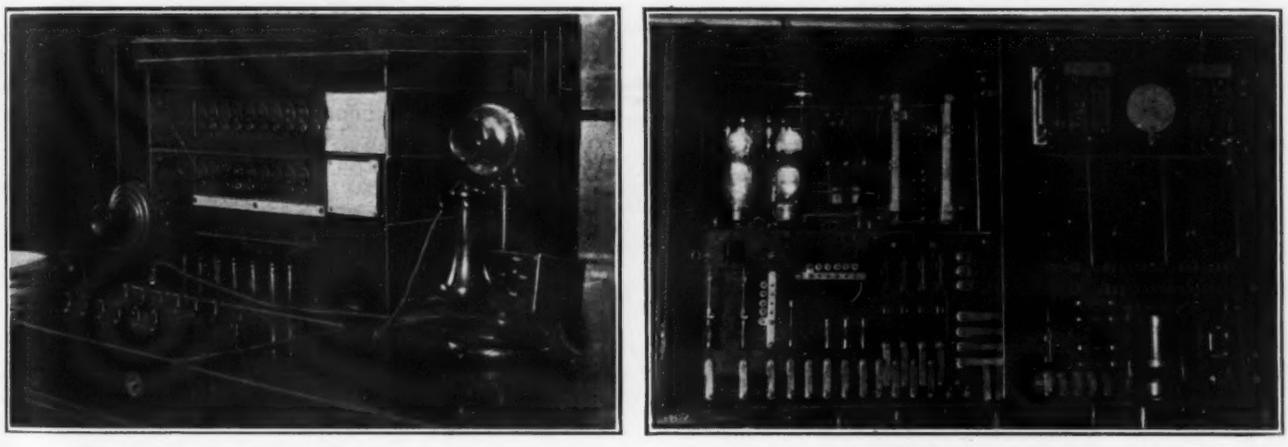
The voice volume with these sets is at least as good as on the ordinary commercial telephone system. In fact, one of the amplifiers in the receiving circuit is not in operation in our sets, because with the additional amplifier the receiving volume was so great that it was unpleasant to listen to. The quality of the speech received is practically the same as that over the ordinary commercial telephone system.

One of the very noticeable points in the use of this telephone system to any one who has used the more common dispatching system, in which the telephone lines are run on the same towers with transmission lines, is the very noticeable absence of hum and extraneous noises. There is absolutely no noise discernible from the regular power current in transmission lines, and there has been no interference from any radio signals.

An additional carrier-current telephone set of 250-watt capacity has been ordered to be used in connection with the transmission line now being constructed between the Utica Gas & Electric system and the Northern New York Utilities system. The speech in this case will be transmitted over a 66,000-volt transmission line for a distance of approximately 60 miles, then over a lower-voltage line for a distance of approximately 30 miles, the link between the two transmission lines being closed by means of electrostatic coupling or some equivalent means.

There is one very interesting development being carried out in connection with the new set which has been ordered to provide for talking with several different systems without any system being able to receive conversations or calls directed to another. Where a company is interconnected with two or more companies it is essential that communication between the central company and the various other companies be carried on without interferences with carrier-current systems operating in any of the other companies and without the conversation being receivable by any of the other companies. It appears that this company was the first to call this to the attention of the manufacturers and to ask for sets capable of talking on several different systems without interference between systems. The manufacturers were quick to see the need of this further development, and there is promise of its being carried to a successful conclusion in the near future.

E. P. PECK,
General Superintendent.
Utica Gas & Electric Company,
Utica, N. Y.



CARRIER-CURRENT SETS OPERATING SATISFACTORILY OVER 12½-MILE, 44,000-VOLT LINE

Single-Phase Transformer Ratings Standardized

ADDITIONAL standard ratings for single-phase power transformers have been recently adopted by the Electric Power Club and became effective Jan. 1, 1923. The ratings include transformers to take power from standard circuit voltages, namely, 44,000, 66,000, 88,000, 110,000, 132,400, 154,000 and 220,000, and to supply secondary distribution at voltages above 4,000. The standard sizes, voltage ratings and taps of step-down transformers for supplying lighting and power service as they now stand are given in the accompanying table.

The standard types of transformers are self-cooled oil-immersed, water-cooled oil-immersed and air-blast. The application of air-blast transformers is confined to systems where the voltage does not exceed 25,000. Standard frequencies are 25 cycles and 60 cycles. Standard sizes for oil-immersed self-cooled transformers in kilovolt-amperes continuous rating at 55 deg. C. rise are 250, 333, 400, 500, 667, 833, 1,000 1,250, 1,667, 2,000, 2,500, 3,333, 5,000, 6,667, 8,333 and 10,000. For water-cooled oil-immersed or air-blast transformers the lowest rating is 500 kva., the sizes above this being the same as for the self-cooled type.

Transformers given in the table having a low-voltage rating of 230/115 are arranged for series or three-wire service only. Transformers having low-voltage rating of 230/460 are suitable for series or multiple service only.

Standard single-phase step-down power transformers for supplying secondary distribution and having voltage ratings listed in the table will be designed for successful operation when excited on full winding at 5 per cent above their rated voltage.

Where a standard transformer is suitable for normal application at two voltage ratings, this flexibility will be definitely indicated on the nameplate, on the connection diagram or on a paster inside the transformer cover.

This additional information will be incorporated in the next edition of the handbook of electrical apparatus standards, published by the Electric Power Club.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

STANDARD RATINGS FOR SINGLE-PHASE POWER TRANSFORMERS FOR SUPPLYING LIGHTING AND POWER SERVICE

Voltage ratings shown in bold type are the normal voltage ratings of these lines and, unless otherwise specifically requested, manufacturers will offer guarantees covering electrical characteristics such as efficiency, regulation, etc., on these normal ratings only.

For Supplying Service Voltages 600 and Below

Standard System Voltages	Standard Sizes for Each Voltage Class	Transformer High-Voltage Ratings for Operation from Various Standard System Voltages					Transformer Low-Voltage Ratings for Supplying Service Voltages 600 and Below
	Oil-Immersed Self-Cooled	On Full Winding	Approximately on Taps 2½%	5%	7½%	10%	
2,300	250 to 500	2,200	2,145	2,090	2,035	1,980	to 220/110 (3-wire) ..or to 220/440 ..or to 550
		2,300	2,245	2,185	2,130	2,070	to **230/115** (3-wire) ..or to **230/460** ..or to **575**
4,600	250 to 500	2,200	4,290	2,090	4,070	1,980	to 220/110 (3-wire) ..or to 220/440 ..or to 550
		4,400		4,180		3,960	
		2,300		2,185		2,070	
		4,600	4,485	4,370	4,255	4,140	to **230/115** (3-wire) ..or to **230/460** ..or to **575**
6,600	250 to 500	6,600	6,435	6,270	6,105	5,940	.....to 220/440 ..or to 550
		6,900	6,730	6,555	6,385	6,210	.....to **230/460** ..or to **575**
11,000	250 to 500	11,000	10,725	10,450	10,175	9,900	.....to 220/440 ..or to 550
		11,500	11,215	10,925	10,640	10,350	.....to **230/460** ..or to **575**
13,200	250 to 500	13,200	12,870	12,540	12,210	11,880	.....to 220/440 ..or to 550
		13,800	13,455	13,110	12,765	12,420	.....to **230/460** ..or to **575**
22,000	250 to 500	22,000	21,450	20,900	20,350	19,800	.....to 220/440 ..or to 550
		23,000	22,425	21,850	21,275	20,700	.....to **230/460** ..or to **575**
33,000	250 to 500	33,000	32,175	31,350	30,525	29,700	.....to 220/440 ..or to 550
		34,500	33,640	32,775	31,915	31,050	.....to **230/460** ..or to **575**

For Supplying Distribution Voltages Above 600

Standard System Voltages	Standard Sizes for Each Voltage Class		Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages					Transformer Low-Voltage Ratings Supplying Secondary Distribution			
	Oil-Immersed Self-Cooled	Oil-Immersed Water-Cooled or Air-Blast	On Full Winding	Approximately on Taps 2½%	5%	7½%	10%	To	Or to	Or to	Or to
6,600	250 to 2,500	500 to 5,000	**6,600**	6,435	6,270	6,105	5,940	**2,300/4,000Y**			
11,000	250 to 2,500	500 to 5,000	**11,000**	10,725	10,450	10,175	9,900	**2,300/4,000Y**			
13,200	250 to 2,500	500 to 5,000	**13,200**	12,870	12,540	12,210	11,880	**2,300/4,000Y**			
22,000	250 to 10,000	500 to 10,000	**22,000**	21,450	20,900	20,350	19,800	**2,300/4,000Y**	**6,900**		
33,000	250 to 10,000	500 to 10,000	**33,000**	32,175	31,350	30,525	29,700	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
44,000	250 to 10,000	500 to 10,000	**44,000**	42,900	41,800	40,700	39,600	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
66,000	250 to 10,000	500 to 10,000	**66,000**	64,350	62,700	61,050	59,400	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
88,000	500 to 10,000	667 to 10,000	**88,000**	85,800	83,600	81,400	79,200	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
110,000	1,000 to 10,000	1,250 to 10,000	**110,000**	107,250	104,500	101,750	99,000	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
132,000	1,250 to 10,000	1,667 to 10,000	**132,000**	128,700	125,400	122,100	118,800	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
154,000	1,667 to 10,000	2,000 to 10,000	**154,000**	150,150	146,300	142,450	138,600	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**
220,000	2,000 to 10,000	2,500 to 10,000	**220,000**	214,500	209,000	203,500	198,000	**2,300/4,000Y**	**6,900**	**11,500**	**13,800**

Signposts to Economies in Small Stations

BETTERMENT work in the operation of small central-station companies is receiving widespread attention at present, and various lines of attack on waste are being followed with good results in many parts of the country. The following representative "leads" were noted recently in visiting stations which were trying to make the most of existing equipment as well as to install new and economical generating units and auxiliaries:

Substitution of two Klaxon horns and an individual forge blower for an air whistle and compressor service in station forge shop. This secured a marked reduction in the hours of daily operation of an air compressor.

Measurement of the foot-candles of illumination in various parts of the plant, from the coal pocket to the operating gallery, with a tabulation of desirable intensities and lighting unit sizes.

Check-up of station lighting circuits and switching arrangements to permit reduction of energy consumption in maintaining illumination in sections of the plant periodically but not continuously under close operating observation.

Installation of industrial ash car operated by storage battery to reduce labor of ash disposal.

Provision of plane mirror at proper angle outside boiler room to reflect image of chimney top for convenience of boiler-room force in checking smoke

emission and maintaining rules of smoke density laid down by state authorities.

Removal of 6,600-volt knife switches from location within 3 ft. of flow line to height of 12 ft., for safeguarding switchboard operator's work at rear of panels.

Concentration of indicating and recording instruments for boiler-room service in inclosed office at central point in boiler house to facilitate control of boiler units, draft, feed water, etc., and more quickly effect changes in handling when inefficient conditions appear.

Analysis of economical load points or range of efficient service by auxiliaries to insure better handling of such apparatus in connection with fluctuations of station output.

Preparation of special log sheet to record interconnection data, routine and emergency service conditions, to insure more accurate permanent records of operation and provide a basis for deeper economic studies of interplant handling.

Provision of glass-inclosed office in old transformer station serving industrial area to reduce amount of heating required in winter as compared with former practice of steam-heating entire building. Group assembly of all transformer-cooling water-supply valves in recess in switch house, with visual indication of rate of flow and massed thermometric facilities under immediate observation of load dispatchers.

Relocation of transformer bank for city substation next to outer wall facing alleyway and provision of rolling steel doors and screens in place of former brick wall to increase supply of outside air drawn in by motor-driven ventilating fans under peak loads and thereby gain transformer capacity.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Slotting Improves Commutator Operation

Operating Conditions Determine Best Method of Undercutting for Any Particular Machine—Proper Selection and Application of Brushes Important

COMMUTATOR slotting, or undercutting, has been fast gaining in popularity among operating engineers during the past few years. Slotting is cutting or grooving the mica lying between the commutator segments below the surface of the copper so as to allow only copper to come into contact with the brushes. Formerly methods were more or less haphazard, and in many cases the results hoped for were negative and troubles that were intended to be eliminated were multiplied. This, in many instances, resulted in turning the operator against the whole idea of slotting, and it is still dwelt upon by some as an indictment against all slotting.

Later experience and practice have proved that the operation of any commutating-type machine can be improved by using a method of undercutting applicable to the type of the individual machine and its operating conditions, together with the selection of the correct grade of brush material and the correct application of the brushes to the commutator. Some of the many benefits to be derived from proper slotting and brush selection may be enumerated as follows:

Decreased Commutator Wear.—On slotted commutators brushes with no abrasive characteristics can be used, while on flush mica commutators it is necessary to use a brush material having a degree of abrasive action sufficient to keep the harder mica flush with the copper.

Increased Brush Life.—As it is not necessary to use abrasive brushes on undercut commutators, it is possible to obtain a much better polish both on the surface of the commutator and on the face of the brushes.

Decrease (if Not Elimination of) Glowing of Brushes, Sparking, Ring Fire and Commutator Surface Burns.—The most common cause of these conditions is high mica, which slotting abolishes.

Reduction of Frictional Losses.—Frictional and abrasive characteristics of brush material are closely related, and the use of a brush having no abrasive characteristics means also a material of minimum friction. Reduction of this loss from friction has in many cases amounted to 1½ per cent to 2 per cent of the total output of the machine, and it is directly reflected in the coal bill.

Decrease in Operating Temperature Under Set Load Conditions.—All brush friction is transformed into heat energy at the brush face; therefore, by reducing the friction to a minimum the heat due to friction is also reduced to a minimum.

Increase in Allowable Load.—Two factors contribute to this result, (1) reduction in heat due to friction, and (2) the fact that non-abrasive brush materials almost always have a lower specific resistance, which reduces the heat due to current flow.

Decreased Tendency to Develop Flat Spots.—Sparking and burning are reduced, and these are the most common causes of the development of flat spots.

There are several methods of undercutting in general use, some of which are excellent and others of questionable value. Machines and tools of various kinds for undercutting are on the market, and all have their advantages for certain classes of work. Machine tools for this work are usually circular-milling saws operated by some convenient power method. Hand tools are of various types, including holders for pieces of hack-saw blades, shaped raking cutters, files and other implements. Of the hand tools, the curved file with the offset handle has proved to give best results under average industrial operating conditions.

In all cases where the job of slotting is to be done the following general rules apply:

Be sure that the commutator is round and free from flat spots, that there is no eccentricity, and that there are no grooves around the commutators. If any of these conditions exist, the commutator should first be trued up by grinding or turning.

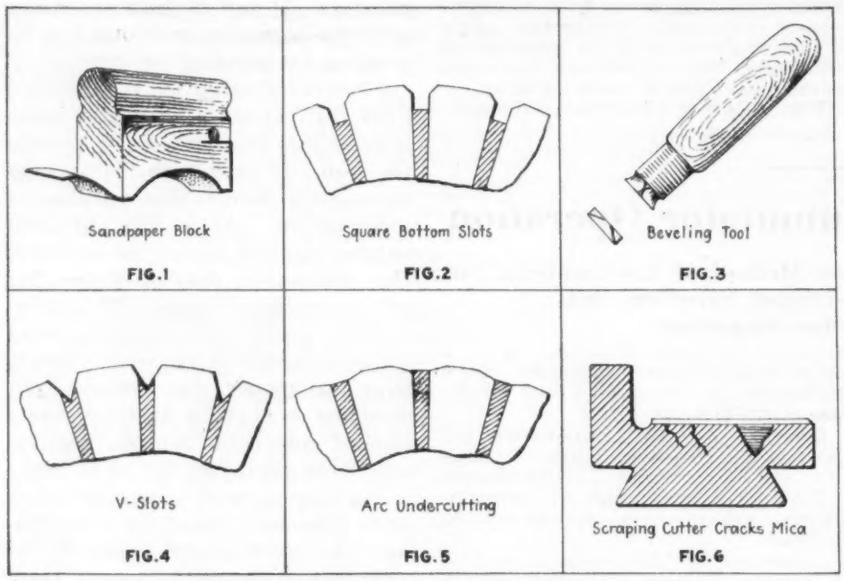
After the slotting job is completed a careful inspection should be made to make sure that no particle of mica has been left flush with the bars, as this always defeats the purpose of undercutting. After this the commutator surface should be polished. This can best be done by a very fine grit commutator stone. If a commutator stone is not available, very fine sandpaper can be used. Before using sandpaper, the coarser grit should be worn off by drawing over a piece of steel a few times. Best results from sandpaper can be obtained by backing up with a wooden block cut to the curvature of the commutator. A satisfactory method of anchoring sandpaper to such a block is shown in Fig. 1.

As there are various methods of slotting, conditions of operation determine the best method for any particular job. These methods are divided into three general classifications—square-bottom slotting, "V" slotting and arc slotting, of which the "V" type has the widest range of application.

In the following paragraphs the poorest of operating conditions have been assumed, and under good operating conditions figures for minimum peripheral speeds at which slots will clear will be considerably reduced. Commutator diameters have not been taken into consideration, figures being based on the average diameter of commutators found in the average industrial equipment. Small-diameter commutators will clear at somewhat lower peripheral speeds than those of larger size. However, if figures given are followed in practice, satisfactory results will be obtained, as errors are on the side of safety.

Square-Bottom Slots.—The square-bottom type of slot is adapted to high speeds only. This slot is usually put in by the use of power-driven milling saws or hack-saw

blades. It has been found that the maximum depth of this style of slot that will positively clear itself is $\frac{3}{64}$ in., and it is then positive in its action only at peripheral speeds of 5,000 ft. per minute or greater. This practically limits the use of the $\frac{3}{64}$-in.-deep square-bottom slot to turbine-driven commutating machines and some 60-cycle rotary converters. The square-bottom slot of $\frac{1}{32}$-in. depth is positive in its clearing action at peripheral speeds of 3,500 ft. per minute or greater and can be used to advantage on many larger generators and rotary converters having a commutator speed above this figure.



METHODS OF COMMUTATOR SLOTTING THAT IMPROVE THE OPERATION OF MACHINE

In the machining of the square-bottom slot there are several details which may seem of minor importance, but careful attention to them is absolutely essential if best results are to be obtained, and they cannot be emphasized too much. Where the power-driven milling saw is used it is impossible to prevent it from coming in contact with the sides of the bars, and wherever this occurs some of the copper is cut or dragged off. Usually the dragging or tearing action is pronounced. This has the effect of cold-drawing on the side of the bar, which causes a hardening of the copper at the side of the slot, and no matter how carefully the surface of the commutator may be smoothed or polished after slotting, there is a knife edge of hardened copper at the edges of each bar. This hardened knife edge will not wear down uniformly with the softer center of the bar and after a time will have a tendency to start flat spots in the center of the bars. This causes the bar edges to run high and act as scrapers against the brush face, shortens the brush life and causes an excess of carbon dust which, in the end, may result in flashovers and the breakdown of the machine. With such possibilities it is, therefore, advisable always to bevel the edge of the commutator bars as indicated in Fig. 2. A bevel surface of approximately $\frac{1}{64}$ in. is sufficient for this purpose. Beveling can be accomplished by the use of an ordinary three-corner slim-taper file or with a sharp cutting edge such as a strong pocket knife or a special tool like that shown in Fig. 3.

It is a proved fact that the number of car-miles per motor failure obtained on one interurban railway line in the Southwest was increased more than 30 per cent by beveling the edges of the bars where square-bottom slots were used.

V Slots.—As has been previously stated, the V slot (Fig. 4.) has a wider range of application than any of the other types and in time is bound to be accepted as the standard method of slotting for all machines operating under average industrial conditions. At the present time there are no power-driven tools on the market for slotting in this manner, and this makes necessary the use of hand tools to get the results desired. Hand tools are comparatively slow, and many operators, while admitting the advisability of using the V slot, continue to use a square-bottom type solely because of the time saving of power machinery. It is, however, a fact that the improvement to be gained in operation will often pay many times over for the difference in labor cost of putting in the V slot. A V slot of 60-deg. angle, the bottom being slightly rounded, cut to a depth that will bevel the copper to about $\frac{1}{64}$ in. at the sides of the slots, will clear itself at peripheral speeds of 1,200 ft. per minute or greater. A careful check of surveys made covering thousands of motors and generators in many industrial and central-station plants shows approximately 76 per cent of the machines operating with a commutator speed in feet per minute greater than 1,200 and less than 3,500, which is the minimum limit for square-bottom slots.

Arc Undercutting.—While entirely satisfactory on any machine and under all conditions on account of the cost of properly machining, arc undercutting (Fig. 5) is limited in application to those machines that will not operate satisfactorily when slotted by any other method. When properly machined there is no minimum speed limit at which arc undercutting will not clean, even when the machine is operating under the most adverse of conditions such as engine exhaust, steam, water or oil splash. To get these results, however, it is absolutely necessary that slot machining be held within very close limits. Careful observation of several cases where this method has been used to overcome commutation faults has established 0.010 in. as a maximum depth of undercutting at which cleaning action is positive at very slow speeds. Moreover, the total width of the slot at the top should not be less than two and one-half times nor more than three and one-half times the thickness of the mica.

There is one method of machining slots occasionally used which very often is the primary cause of serious machine trouble. This is the use of raking-type cutters, whether used by hand or in the tool rest of a lathe. Mica is hard and brittle, and the use of any raking or scraping cutter having a single cutting point is almost sure to cause small cracks or checks in the mica at the bottom of the slots, as indicated in Fig. 6. Where any oil or moisture is present it finds its way into these small cracks and breaks down the insulation between bars, often causing the mica to char and burn all the way to the spider or shaft, thus bringing about complete machine failure.

The different methods of slotting recommended above will always prove satisfactory when properly applied to machines in continuous operation. Very often, however, on machines used intermittently, where oil creeps from the bearings, or the atmosphere is moist, oily or dirty, or corrosive fumes are present, failures directly traceable to the slotting develop. Where conditions such as those described occur this trouble can be eliminated by coating or filling the slots with a good grade of shellac, certain air-drying insulating varnishes or some of the commutator cements sold for that purpose. Care should be used in the selection of this material. It must have good adhesive properties. It must dry hard and not gum, but it must not become harder than the copper commutator bars. It must not be affected by oil or moisture and it must be free from abrasive qualities.

With a slotting job properly done, the selection of the grade of brush material to be used on the commutator is of the utmost importance. The brush that gave satisfactory service on the machine while operating with flush mica will not operate correctly after undercutting. Brush material on flush mica commutators must have a degree of abrasive action, which on undercut commutators would be expended entirely in cutting out the softer copper, resulting in greater commutator wear than before undercutting. This would mean more copper dust and a correspondingly greater possibility of failure in insulation, with the consequent breakdown of the machine.

With the proper grade of brush material selected, the application of that grade to the machine becomes of prime importance. Brush angle, brush pressure, brush staggering and fitting of brushes to the commutator should all receive consideration. Brushes with low friction should be more nearly radial than those having high abrasive characteristics. Brush pressure on slotted commutators should usually be somewhat less than where abrasive brushes are used on flush mica. Staggering should be by pairs of studs instead of by single studs. New brushes never exactly fit the commutator, and in order to get the proper contact they should be sandpapered in by pulling the sandpaper in the direction of rotation of the commutator.

With correct slotting, the correct brush applied in the proper way, the machine should operate quietly, without chatter, spark, squeal or burn. No lubricant should ever be used on slotted commutators, and if everything is correct it will not be needed.

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Damage from Oxygen in Boiler-Feed Water

WATER containing oxygen in solution actively corrodes the tubes of steel-tube economizers and boilers. The serious harm due to such corrosion can be inferred from Fig. 1, showing the amounts of iron converted into rust in a year by an hourly supply of 1,000 lb. of water containing different amounts of oxygen in solution. Where economizers have been put in without suitable de-aërating means they have in several instances been destroyed by pitting within a year or less.

Open heaters receiving sufficient exhaust steam at all times to bring the water up to 212 deg. F. or above greatly reduce the corrosion, but since the amount of heat recovered by the economizer depends upon the difference between the temperature of the flue gases and the temperature of the water, it is generally desirable in the interests of over-all plant economy to supply water to economizers at the lower temperatures. Ordinarily the flue gases enter the economizer at a temperature between 550 deg. and 650 deg. F. and leave at a temperature between 250 deg. and 350 deg. F., having therefore a mean temperature of about 450 deg. F. If the feed water enters the economizer at 200 deg. F. and leaves at, say, 300 deg. F., giving a mean temperature of 250 deg. F., the average temperature difference will be in the neighborhood of 200 deg. F. If, on the other hand, the water enters at 140 deg. or 150 deg. F., the temperature difference, and therefore the fuel saving and money return upon the economizers, will be increased by about 20 per cent.

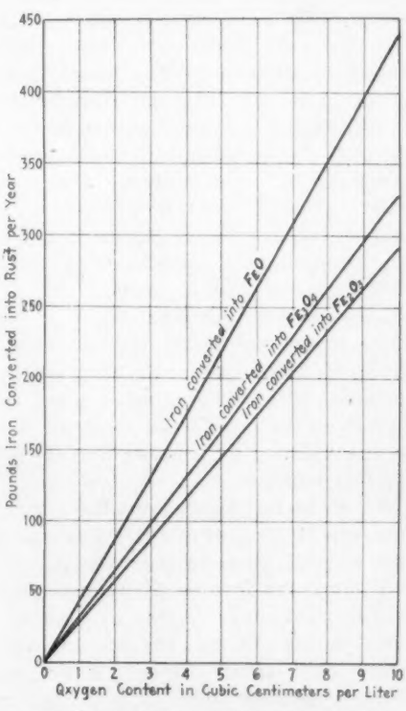

FIG. 1—IRON CONVERTED INTO RUST YEARLY BY 1,000 LB. OF WATER PER HOUR

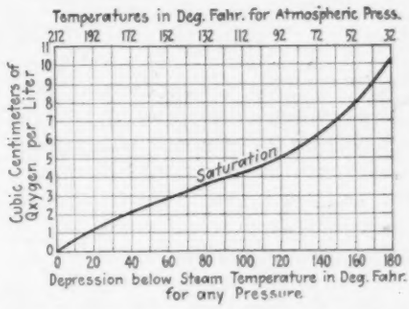

FIG. 2—OXYGEN CONTENT OF WATER HEATED TO VARIOUS TEMPERATURES

The extent to which oxygen can be driven out of solution by heating water to the boiling point under atmospheric pressure is shown in Fig. 2. The problem of heating water to the full temperature of the steam in an open heater resolves itself into that of removing non-condensible gases from the steam space. If the venting is done directly from the steam space, large quantities of steam must be vented in order to keep down the concentration of air.

If the amount of steam supplied is insufficient to heat the water to atmospheric boiling point, the temperature of the feed water will vary according to the relative amounts of steam and water, and in order to secure de-aëration at the lower temperatures, means must be provided for maintaining a vacuum in the heater corresponding to the pressure of water vapor at the temperature to which the water is heated. This condition will be fulfilled if the accumulation of non-condensible gases in the heater is prevented, as by withdrawing a portion of the heater atmosphere continuously by means of a steam-jet air pump or ejector. For operation under vacuum conditions special apparatus has been developed.

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Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

The Present Status of Rural Service*

Eventual Modification of Agricultural Processes and Equipment Will Increase Use of Energy to a Point Profitable to Both the Central Station and the Farmer

By J. C. Martin
Western Editor Electrical World, Chicago

SEEING the advantages of electric service in cities and towns and sensing its economic possibilities in agricultural operations, the farmer has not been able fully to understand why an electric power supply cannot be as readily taken to his door as it has been to that of the city man. He has made attempts, with more or less success, to get his power supply by building lines to the central-station system and buying power on a wholesale basis, doing his own distributing and thereby in many cases entering, legally at least, into the utility business and assuming without realizing it responsibilities that have later proved a severe burden. All sorts of errors, some ludicrous and some tragic, have been committed in such projects.

Some success has been attained, but it is not of the character that indicates the lines along which practice will finally stabilize. After four or five years of work both the seller and the consumer are still groping very much in the dark and the solution seems as far off as ever. As a matter of fact I believe that the difficulty lies largely in the old human failing of refusing to look a problem over and analyze it to see what is involved.

Nature of the Problem

Two facts are thoroughly proved in economic experience. One is that the seller must make a profit if he is to continue in the business of selling a product. The other is that the buyer must make a profit from the use of the thing he buys. In the case of the buyer the profit does not always come in the form of a money balance. It may come in the form of better living conditions or better health, or in numerous other ways. However, if he is using the things he buys in a producing business from which he derives an income, then he must be able to turn those things into more cash than he pays for them, including the labor and process costs through which he must put his raw materials.

There are two sides to this question, and, to dispose first of the one which seems to be simplest, the seller's problem will be discussed briefly. The central-station man called upon to give service anywhere has certain total cost limits below which he cannot go in establishing the service. The costs per consumer are controlled in certain items by the number of consumers he can serve with a given amount of material in the form of service plant. In certain other items the cost is independent of the number of consumers. When called upon to build a city line he can figure eventually on from approximately twenty to one hundred consumers per mile of line. Probably the general average is around fifty per mile or slightly less. Called upon to serve the same class of consumers in rural territory, he cannot expect in the Middle West and Far West more than three per mile, and the general average in service so far established is less. The expense per consumer which is affected most by the number served by a given line is the biggest expense.

When he has figured out the entire problem he finds that for a line costing a given sum in city service he will serve say forty to fifty consumers and in the country a line costing approximately one-half the amount will serve only about three consumers. This is because there is a minimum amount of material that can be used in building a line that will stand up under the climatic and other physical conditions it must meet. This amount of material has no relation to the number of consumers. It must be used to secure physical strength. He also has to face the fact that in maintaining his rural lines he must arrange to travel miles for service and maintenance purposes where in his city or town service the travel is measured in blocks. Good pavements in city work and poor roads in many country districts serve to widen the difference in expense. The difference in expense is inherent in the method of giving service, and unfortunately it is the only method we know. This is the heart of the central-station side of the problem, and it is a wall which prevents placing the service cost to the individual farmer on the same basis as the city dweller.

The User's Problem

The user's problem is divided into two parts. The buyer must distinguish between the uses to which he puts the things he buys. We have heard a great deal of the need of improving farm living conditions in the past few years. Much of this has had to do with the farm home. If he can make the other part of his activities pay him a fair return on his investment, the farmer can afford to spend money on improvements in living conditions in the home. In fact, he is doing this in many directions. In using electrical energy the question is how can he make it relieve the home conditions. The way to the solution of this problem is well paved by the developments in city homes, so far as light, the sewing machine, the washing and ironing machine and the ordinary items of home use are concerned. Such items of equipment as the electric range and the refrigerator require educational development. Merely placing them in the farm kitchen will not solve the problem. That they have great possibilities is certain, and a considerable amount of study can be devoted to their use on the farm.

The other and by far the biggest

*From a paper presented before a meeting of the American Society of Agricultural Engineers at St. Louis, Dec. 27, 1922.

possibilities, however, lie in the field of farm work that corresponds to the business activities of the city business or industrial man. It seems that the time has come when the farmer must view his producing problems in exactly the same light as the factory owner or executive views his production problems. In other words, the farm as a producing agency is a factory.

The farmer uses power. For centuries that power has been human or animal because such power has been cheap. In America cheapness is no longer a certain feature of human labor unaided by machinery. I think it is fair to question whether animal labor is not also reaching that point in many places. I understand from farm sources that it requires the products from several acres of ground each year to sustain a single horse.

POSSIBILITIES FOR INCREASED PRODUCTION

If by means of machine equipment the products of that ground can be turned to other uses, what is the gain to the farmer? If it is possible to increase the production per man from this acreage and the remaining acreage now devoted to other purposes, what is the value of such a gain to the farmer? If it is possible, for example, to reduce the number of horses used on a 600-acre farm to two, as one English investigator claimed recently could be done, by the use of some form of power other than animal, what is such a gain worth to the farmer in the solution of his production-cost problems?

In a recent discussion it was pointed out that forced curing of hay had been resorted to in an experimental way in England, and the results seemed to show that the food qualities of the product are better than where the hay is cured in the ordinary way. The process is simple, and outside of an ordinary fan and motor the only equipment involved was some sort of a tunnel under the stack into which the air is forced and then allowed to escape through the green hay, carrying the moisture with it and curing the hay before destructive processes can set in. There are other crops on which the same process might make for an improvement in product.

This is but one instance of a saving effected by the application of electric power. There are many other benefits, including water supply, haulage and small power applications in the daily routine of farm work, which will minimize or eliminate hand labor.

Many, including men in both the agricultural and electrical fields, believe that the future development of farm equipment must follow in a general way the broad lines of progress that have been followed in the industrial field in the past twenty-five years, namely, the development of equipment of the highest possible mechanical efficiency which requires the least human labor to keep in operation and which places the production possibilities on a plane that hand labor can never approach. If electric power is to be used profitably on the farm, there will probably be as great modifications in farm processes and equipment as have taken place in the industrial field. The problem is neither wholly electrical nor wholly agricultural in its aspect, but it is an economic problem that must be solved by both industries working together in order that the viewpoint of each may be properly considered. It involves a vast amount of research, and the extensive government experiment stations have the facilities to undertake the work. The nub of the problem in reducing the cost of energy delivered at the farm is to increase the use so that the costs of getting service will be absorbed, and leave the farmer with a profit as the result of his expenditure.

Power-Factor Table Lessens Billing Computations

BY GEORGE B. LELAND
General Manager Stamford Gas & Electric Company, Stamford, Conn.

MANY central stations are using the two-meter method of determining the average power factor of their power customers, one meter registering the kilowatt-hours and the other meter registering the reactive volt-amperes.

Our company started using this method of metering with a few of our larger customers about four

TABLE FOR COMPUTING POWER FACTOR

Divide reading of wattless component meter by reading of kilowatt-hour meter. This gives the ratio of the wattless and the true current. Find in table below nearest constant to the ratio above determined and in the column at the left-hand side of table read power factor. Add to this the decimal shown over the top of the column which contains the constant. This will give the power factor to the nearest tenth.

Power Factor	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
95	0.3288	0.3252	0.3214	0.3179	0.3143	0.3105	0.3067	0.3032	0.2994	0.2956
94	0.3630	0.3597	0.3564	0.3528	0.3495	0.3460	0.3427	0.3391	0.3356	0.3323
93	0.3953	0.3921	0.3889	0.3859	0.3825	0.3792	0.3762	0.3729	0.3696	0.3663
92	0.4258	0.4231	0.4200	0.4169	0.4139	0.4108	0.4078	0.4047	0.4015	0.3983
91	0.4557	0.4526	0.4498	0.4470	0.4438	0.4411	0.4379	0.4350	0.4320	0.4289
90	0.4843	0.4816	0.4788	0.4759	0.4731	0.4702	0.4672	0.4642	0.4614	0.4585
89	0.5123	0.5095	0.5068	0.5040	0.5011	0.4984	0.4957	0.4928	0.4899	0.4870
88	0.5398	0.5369	0.5343	0.5315	0.5287	0.5261	0.5233	0.5206	0.5178	0.5150
87	0.5667	0.5641	0.5614	0.5587	0.5560	0.5532	0.5505	0.5479	0.5452	0.5426
86	0.5934	0.5906	0.5881	0.5855	0.5828	0.5801	0.5774	0.5746	0.5721	0.5694
85	0.6196	0.6172	0.6144	0.6118	0.6092	0.6066	0.6040	0.6013	0.5987	0.5961
84	0.6459	0.6432	0.6408	0.6381	0.6354	0.6330	0.6301	0.6277	0.6249	0.6224
83	0.6720	0.6694	0.6669	0.6642	0.6615	0.6590	0.6565	0.6538	0.6511	0.6486
82	0.6980	0.6954	0.6929	0.6903	0.6877	0.6849	0.6824	0.6798	0.6773	0.6745
81	0.7239	0.7214	0.7188	0.7163	0.7135	0.7111	0.7085	0.7059	0.7032	0.7006
80	0.7499	0.7474	0.7447	0.7422	0.7395	0.7371	0.7344	0.7319	0.7292	0.7265
79	0.7761	0.7734	0.7708	0.7683	0.7657	0.7632	0.7604	0.7579	0.7552	0.7526
78	0.8023	0.7997	0.7971	0.7945	0.7919	0.7893	0.7865	0.7839	0.7813	0.7787
77	0.8287	0.8261	0.8234	0.8206	0.8180	0.8154	0.8127	0.8103	0.8077	0.8050
76	0.8551	0.8526	0.8498	0.8471	0.8446	0.8418	0.8391	0.8366	0.8339	0.8312
75	0.8819	0.8793	0.8765	0.8739	0.8711	0.8685	0.8657	0.8632	0.8603	0.8578
74	0.9089	0.9062	0.9036	0.9009	0.8980	0.8955	0.8928	0.8899	0.8873	0.8847
73	0.9363	0.9336	0.9306	0.9279	0.9252	0.9225	0.9198	0.9172	0.9145	0.9115
72	0.9637	0.9612	0.9584	0.9556	0.9528	0.9501	0.9473	0.9446	0.9418	0.9391
71	0.9919	0.9890	0.9861	0.9833	0.9807	0.9779	0.9750	0.9722	0.9694	0.9666
70	1.0203	1.0170	1.0144	1.0117	1.0088	1.0058	1.0032	1.0003	0.9974	0.9948
69	1.0489	1.0461	1.0431	1.0404	1.0373	1.0346	1.0316	1.0289	1.0259	1.0230
68	1.0783	1.0752	1.0724	1.0694	1.0664	1.0637	1.0606	1.0578	1.0547	1.0519
67	1.1080	1.1051	1.1020	1.0990	1.0961	1.0930	1.0900	1.0872	1.0840	1.0812
66	1.1383	1.1352	1.1323	1.1293	1.1260	1.1230	1.1200	1.1171	1.1139	1.1111
65	1.1692	1.1660	1.1629	1.1599	1.1568	1.1538	1.1506	1.1474	1.1443	1.1413
64	1.2005	1.1974	1.1943	1.1910	1.1878	1.1847	1.1816	1.1785	1.1754	1.1722
63	1.2327	1.2294	1.2261	1.2229	1.2198	1.2167	1.2135	1.2102	1.2070	1.2038
62	1.2655	1.2621	1.2589	1.2557	1.2523	1.2489	1.2458	1.2426	1.2393	1.2360
61	1.2989	1.2957	1.2923	1.2888	1.2857	1.2822	1.2788	1.2753	1.2723	1.2689
60	1.3335	1.3299	1.3262	1.3230	1.3194	1.3162	1.3127	1.3091	1.3059	1.3024
59	1.3684	1.3650	1.3613	1.3580	1.3543	1.3511	1.3473	1.3438	1.3404	1.3367
58	1.4045	1.4008	1.3972	1.3937	1.3899	1.3865	1.3827	1.3792	1.3755	1.3722
57	1.4415	1.4379	1.4340	1.4304	1.4266	1.4229	1.4193	1.4154	1.4120	1.4080
56	1.4792	1.4756	1.4718	1.4678	1.4641	1.4605	1.4565	1.4527	1.4490	1.4451
55	1.5185	1.5147	1.5105	1.5066	1.5027	1.4988	1.4951	1.4910	1.4872	1.4835
54	1.5587	1.5547	1.5507	1.5465	1.5425	1.5384	1.5345	1.5304	1.5262	1.5224
53	1.6000	1.5958	1.5916	1.5875	1.5834	1.5792	1.5751	1.5711	1.5667	1.5627
52	1.6426	1.6383	1.6340	1.6297	1.6255	1.6212	1.6170	1.6128	1.6083	1.6042
51	1.6864	1.6820	1.6775	1.6731	1.6687	1.6643	1.6599	1.6555	1.6512	1.6469
50	1.7321	1.7274	1.7228	1.7182	1.7136	1.7090	1.7045	1.6999	1.6954	1.6909

years ago, and one of the first problems we had to solve was that the billing department was unable to determine the power factor of the consumer when it received the readings from the indexers. After trying out various methods and "graphs," the accompanying table (cosines and tangents) was worked out. After two years' use it has fully solved the problem and enables any billing clerk accurately to determine the power factor of the consumer and bill him in accordance with our rate.

Company Garage Has Model Electrical Installation

SOME power companies are prone to devote too little attention to the type of wiring which goes into their own buildings because the men are so familiar with their work that they can be trusted to handle a rough installation. In consequence temporary wires are often used for months or years in positions where a power man would advise the most permanent type of wiring if the installation were being made on a customer's premises.

In the belief that the public will be impressed by the example set by the electric company, the San Joaquin Light & Power Corporation has installed model electrical equipment in its new garage building. Wiring is in conduit throughout and switchboards are well arranged and of the latest design.

More than one hundred of the company's cars are stored in this building, and from 200 to 225 are cared for here for repairs. In addition to the repair work on the cars, which calls for a paint shop and an upholstery repair shop as well as the main machine shop, any heavy machine work in connection with company construction requirements is handled in the garage.

An average of 4,000 kw.-hr. per month is used for power purposes, with a total motor installation of 117.5 hp. as shown below, the figures indicating horsepower:

Machine Shop.—Band saw, 7.5; hack saw, 0.5; grinder, 2; drill press, 2; sensitive drill, 1; shaper, 2; grinder, 0.5; milling machine, 3; cylinder driver, 5; universal driver, 3; 14-in. lathe, 2; 18-in. lathe, 5; 18-in. lathe, 3; 12-in. lathe, 2; threading machine, 3; threading machine, 3; drill press, 3; punch, 5; grinder, 3; air compressor, 30.

Garage.—Bearing burning-in, 10; bearing burning-in. 20.

Filling Station.—Gasoline pump, 2.

All machines are remote-controlled with push-button operation and are protected with approved safety features. In addition to the motor load, there is a 25.9-kw. lighting and fan load with an average monthly consumption of 3,500 kw.-hr. during the summer and 3,000 kw.-hr. during the winter. Heating is accomplished by 1,800-watt heaters, but this installation is too recent to furnish figures for consumption.

Besides serving as an example of good wiring which may be used in selling adequate illumination and modern installations to garage owners and machine shops, this garage has the added advantage to the company of providing for the grouping of all cars at one place, a feature which permits of their being regularly inspected for repairs at frequent intervals.

The paint and upholstery shops located on the premises facilitate keeping up the appearance of the company's cars, a factor which influences the attitude of the community.

Customers Oversubscribe Holding Company Stock

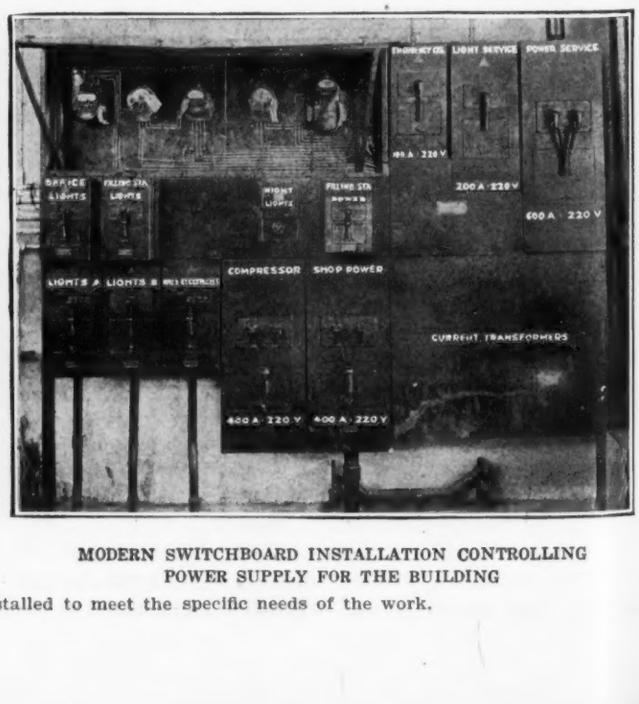
CUSTOMER ownership of holding-company stock, which was successfully tried out by the United Light & Railways Company of Davenport, Iowa, as described by H. E. Weeks, manager of the company's securities department, in the ELECTRICAL WORLD of March 18, 1922, has further proved its value. Not only was a second block of $1,000,000 of prior preferred stock sold on this plan, but this quota was oversubscribed by $200,000.

During the latter part of March, 922, the directors of the company authorized the sale of another $1,000,000 of prior preferred stock to the customers of the company. The previous block of stock had been sold almost entirely through the employees, the only exception being that in some of the larger localities a few paid salesmen were employed.

When it was decided to sell the $1,000,000 of stock between April 1 and Dec. 31 a definite quota was assigned to each of the sixteen companies operated by the United Light & Railways Company. During the period between April 1 and Aug. 31 the employees were not urged to sell the stock, but approximately $200,000 was sold during that period.

With the opening of fall, however, the effort was intensified, and during

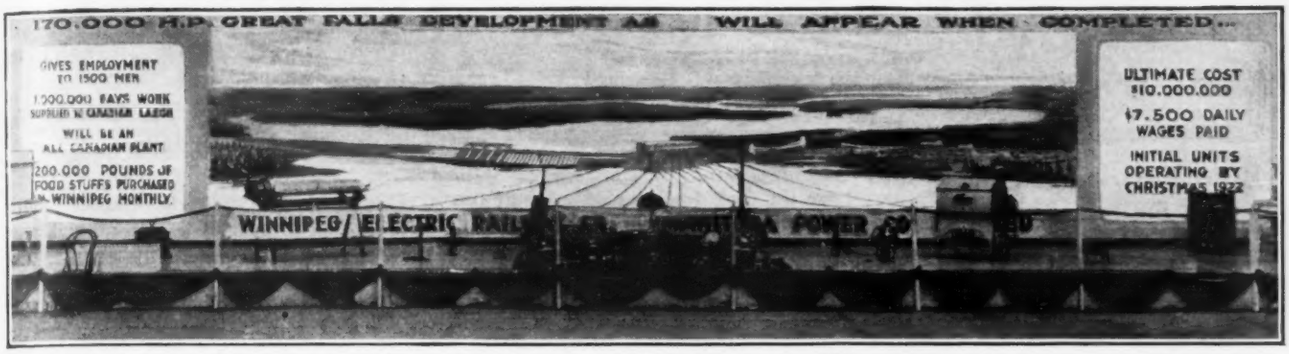
MAIN MACHINE SHOP, SHOWING CONDUIT WIRING, INDIVIDUAL DRIVE AND PUSH-BUTTON CONTROL



MODERN SWITCHBOARD INSTALLATION CONTROLLING POWER SUPPLY FOR THE BUILDING

The illumination is carefully planned and installed to meet the specific needs of the work.

Purchasing and Employment Value of a Water-Power Development


170,000 H.P. GREAT FALLS DEVELOPMENT AS WILL APPEAR WHEN COMPLETED...
GIVES EMPLOYMENT TO 1500 MEN
1,000,000 DAYS WORK SUPPLIED TO CANADIAN LABOR
WILL BE AN ALL CANADIAN PLANT
200,000 POUNDS OF FOOD STUFFS PURCHASED IN WINNIPEG MONTHLY
ULTIMATE COST $10,000,000
$7,500 DAILY WAGES PAID
INITIAL UNITS OPERATING BY CHRISTMAS 1922
WINNIPEG ELECTRIC

WHAT hydro-electric construction work means to a city in the employment it gives to labor and the money spent with merchants for various supplies was graphically depicted in a joint exhibit by the Manitoba Power Company and the Winnipeg Electric Railway Company at a recent industrial show in Winnipeg. As will be seen from the accompanying view of the exhibit, the 170,000-hp. water-power project under construction at Great Falls was the feature of the display. How much this will mean in added business for merchants of the city is emphasized by statements of the amount of money and labor necessary to build the plant. For instance, it will require the employment for nearly two years of 1,500 men, who are paid an aggregate of $7,500 in wages, daily. Furthermore, 200,000 lb. of foodstuffs to feed these men is purchased monthly in Winnipeg.

the month of September approximately $125,000 of stock was sold, while during October $250,000 in stock was disposed of. The results during the first few days of November were especially gratifying. Announcement had been made about Oct. 15 that the price of the stock would be advanced on Nov. 15 from par to $102 a share. This served as a stimulant to sales and there was sold in the first two weeks of November $625,000 of stock, or at the rate of $16,000,000 a year. The sales for the last six weeks of the campaign totaled $875,000.

The United Light & Railways Company serves 600,000 people, but all of the territory embraced was not opened for sales during the entire period of the campaign. In Chattanooga the sale of stock did not begin until about two weeks before the closing of the campaign. This city was the only one which did not sell its quota. Although the Grand Rapids territory was opened about a month before the close of the campaign the quota was oversold by 140 per cent.

Cadillac, Mich., was also very late in getting started on its sale and had less than a month to sell its quota. Despite this, however, the allotment there was oversold. More than half of the stock was sold in territory known as Tri-City territory, which embraces the cities of Davenport, Rock Island and Moline. It is very significant that the territory where industrial conditions were probably most depressed the greatest sales were made. The Peoples Power Company, which operates in Rock Island and Moline, where the great agricultural implement factories are located, sold approximately $300,000 of stock, although the implement factories are practically closed down. The quota assigned there was exceeded by about 80 per cent.

The splendid work done by the trainmen and other employees of the railway companies owned by the United Light & Railways Company was especially gratifying. During the campaign the percentage of ownership of stock by one railway company's trainmen was increased from 36 to 70. Nearly all of the employees assisted in the sale of the stock. Another of the railway companies included in the system of the United Light & Railways Company had almost 100 per cent of stock ownership.

During the year the company sold stock to 2,100 people, and it has on its books today more than 4,600 stockholders in this issue in the communities in which it operates. These stockholders have all been acquired during the last two years. The figures of the company show an average holding of four and six-tenths shares per stockholder.

The "United Go-Getters' Club," which was organized in the fall of 1921 and was described in the ELECTRICAL WORLD article already referred to as having put on a successful sale of $500,000 of stock, did splendid work in "putting over" this sale. Although the later sale was not handled entirely by the "Go-Getters' Club" on all of the properties, as part of the properties have no organized club, the work of the individual "Go-Getters" was largely responsible for the splendid results which were obtained.

What Other Companies Are Doing

Chicago, Ill.—For the week ended Dec. 23, 1922, the electrical energy output of the Standard Gas & Electric Company increased 12.82 per cent over the corresponding week in 1921. Applications for new electric services totaled 1,623, covering 788 kw. of lighting and 1,125 hp. in motors. New customers' connected load shows a net gain of 579.

Indianapolis, Ind.—As Christmas presents to more than nine hundred of his employees, Harry Reid, president of the Interstate Public Service Company, operating interurban and power and light utilities in Indiana, sent life insurance policies ranging in value from $600 to $1,000. A letter of appreciation for services rendered accompanied each policy. The policies are based on the duration of the service of the employees. Those who have been with the company one year and less than two received a policy for $600; two and less than three, $700; three and less than four, $800; four and less than five, $900, and more than five years, $1,000.

Denver, Col.—Frank J. McEniry, general field representative of the Electrical Co-operative League of Denver, in going after additional business has chosen for his attack the poor lighting of homes, and particularly the dining table. In Denver, as in every city, there are many houses which have been wired for a number of years, and it is felt that these customers are not aware of the improvement in home illumination which they can have for a very little additional expense.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Surface Condenser.—C. L. HUBBARD.—The choice of a condenser should be based upon a study of individual plant conditions and is governed to a large extent by the degree of vacuum required and the quality and available quantity of cooling water. The author discusses the advantages and types of condensers and the computation of tube and cooling surfaces.—*Southern Engineer*, December, 1922.

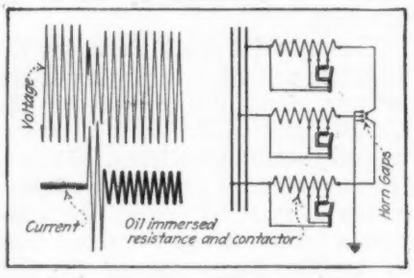
Aspects of Study and Selection of Water-Power Sites.—W. T. TAYLOR.—The author discusses the considerations involved in the selection of power site, stream flow, economical developments, relationship between rainfall and run-off and a survey of natural lakes.—*Canadian Engineer*, Dec. 12, 1922.

Hydro-Electric Generating Sets for Small Output.—C. REINDL.—The author has developed a water-turbine-driven generator set which operates at variable speed but maintains constant voltage without a regulator or any manual attention. This has been reached by the use of a specially wound direct-current dynamo the voltage of which will stay constant within a very wide speed range. High-speed water turbines of the Francis, Pelton, Banki or Kaplan type permit direct coupling with the generator. The absence of a turbine regulator, storage battery or electric regulator makes these sets extremely simple and inexpensive, saving as much as 50 per cent on the investment cost as against a non-automatic set. From a few hundred watts up to 25-kw. output these hydraulic generating sets are standardized.—*Elektrotechnische Zeitschrift*, Dec. 7, 1922.

Generation, Control and Switching

Neon Glow-Discharge Lamps on Direct-Current Circuits.—J. T. MACGREGOR-MORRIS, M. J. DOWTY and B. J. PRIVETT.—The investigation dealt with in this article was carried out to study the behavior and to determine the statical characteristics of two types of neon lamps with a view to further possible applications. The article is illustrated with photographs of the spectra of the two lamps and concludes with a number of suggestions for possible application.—*Electrician*, Dec. 1, 1922.

Overvoltage Problems.—F. SCHROTTKE.—The author gives an interesting account of the development of overvoltage protective apparatus. Much thought and energy have been spent on protective apparatus for electric machines, but the author claims that not all of the investigators were qualified for the task and that as a result much so-called protective apparatus was brought on the market which was either of no value or did actual harm. Shortly after the first 100,000-volt lines were put in operation it was realized that an excellent protection against overvoltages could be obtained from a strong internal insulation of generators and transformers. Such reliable results have been obtained in plants with machines of high winding insulation that practically no external protective apparatus is required. Another series of devices has been developed to guard against the dangers of a ground. Specifically, the Petersen and Bauch quenching transformers have proved useful in many cases. For energies of more than 2,000 kva. these coils, however, are far from fully satisfying. The



OHMIC RESISTANCE IN SERIES WITH HORN GAPS HAS PROVED SATISFACTORY FOR SUPPRESSING GROUNDS

author mentions, for example, that in the large German Golpa power house the Petersen coils were disconnected from the buses after some major troubles and that the station has been operating satisfactorily for more than a year without these coils. He recommends the more extensive use of ohmic resistance in series with horn gaps, for which arrangement broad protective claims are made, substantiated by several years of good experience. An apparatus of this class is described, comprising an oil-immersed resistance and a contactor, with a horn gap on the cover of the oil tank. The contactor short-circuits the greater part of the resistance during normal operation, but opens this short-circuit and thereby inserts the full resistance in case of overvoltage within two cycles. An oscillographic record showing the operation of this apparatus is reproduced here. A further innovation is a spiral-wound choke coil made of a ribbon of copper and a ribbon of nichrome in parallel. Such a coil, the author claims, will not only reduce the voltage of an incoming traveling wave but will also smooth out its steep wave front. The use of condensers as overvoltage protectors is not recommended. The protective value of a grounded steel cable above a transmission line is still being discussed, but the majority of investigators and plant managers seem to disapprove of its extensive use.—*Elektrotechnische Zeitschrift*, Nov. 30, 1922.

Transmission, Substations and Distribution

Possibilities of Transmission by Underground Cables at 100,000 Volts to 150,000 Volts.—A. M. TAYLOR.—Until recent years the methods of trial and error figured largely in the evolution of the transmission of power by underground cables and were successful because of the margin of safety which existed. Today the limits are much closer and a failure is a much more serious contingency, making it necessary that for any further step extensive study of the problems involved, both scientific and commercial, shall be made. Apart from a few pages in which certain fundamental principles are dealt with, this paper, presented before the Institution of (British) Electrical Engineers, consists almost entirely of a description of a special scheme developed for transmitting power over single-core cables provided with concentric potential grading sheaths. Six of the triple concentric cables are employed for a three-phase system and each pair has its six conductors connected to a six-phase supply system, which by being grounded on one side instead of in the center, as is usual, permits of the main conductors of the two cables being worked at a high voltage above earth. A comparison is included of the cost of transmitting 50,000 kw. a distance of 30 miles by this six-phase / three-phase system transmitting at 100,000 volts and the same performance by three-core cables working at 30,000 volts. The saving by the first system is, according to the author, quite pronounced.—*Electrician*, Dec. 15, 1922; *Electrical Review*, Dec. 15, 1922, and *Electrical Times*, Dec. 14, 1922.

Units, Measurements and Instruments

Electrical Timing Device for Short Intervals.—D. ROBERTSON and N. F. FROME.—A short description is given of a timing device for the above purpose, consisting of an inductive resistance in a Wheatstone bridge. The theory of the device is given, as well as an example of its application.—*Journal of the Institution of (British) Electrical Engineers*, December, 1922.

Electric Telemeter.—During the past two years the Bureau of Standards has been engaged in developing electric telemetric devices based upon the fact that carbon-contact resistances vary with pressures or displacements applied to their terminals. Difficulties in using carbon-contact resistances are that the contact resistances in the past have been erratic, that such apparatus has shown large hysteresis effects and that these devices are inherently non-linear in their characteristics. The bureau

has investigated these troubles and has found means of eliminating all of them to a degree which makes the apparatus well adapted to a great variety of engineering measurements. These include measurements of strains in bridge members and other engineering structures, measurements of accelerations, vibrations and pressures of practically every description. The apparatus can be made either indicating or recording as desired.—*Technical News Bulletin No. 68 of the Bureau of Standards.*

Illumination

Theory, Construction and Use of the Photometric Integrating Sphere.—E. B. ROSA and A. H. TAYLOR.—The first part of this paper deals with the materials and construction of various spheres and describes in detail the construction of a reinforced-concrete sphere used at the Bureau of Standards. It gives tests of the accuracy of integration by this sphere, the absorption of light by the sphere coating and by objects in the sphere and effect of the position of the lamps. Proper methods of operation are also outlined. A fairly complete résumé of the general theory of the sphere is given in the second part, with the addition of a considerable amount of new material, showing how to test the accuracy of the sphere and how to improve the accuracy of integration. A complete bibliography of the subject is also given.—*Scientific Paper No. 447 of the Bureau of Standards.*

Motors and Control

Methods for Correcting Power Factor.—E. H. HUBERT.—A practical analysis of how the benefits obtained by correcting power factor can be balanced against the cost in any industrial establishment. Where a large number of motors are used and the loads on them may vary from time to time a careful analysis of operating conditions and power requirements and a wise expenditure of money on corrective measures will show increased profits. The fundamentals to consider in such an analysis are dealt with. The article compares the results with the expenditures in practical examples that can be applied to conditions found in almost every plant. The subject is considered from the viewpoint of the industrial-plant operator, demonstrating to him the advantages to be gained by correcting power factor, among which are better voltage regulations, better rates, in some cases less equipment, reduction of power losses, etc.—*Industrial Engineer,* December, 1922.

Alternating Current and Iron and Steel Works Practice.—J. P. HODGES.—The author strongly advocates the use of alternating current in the steel industry. He points out how conditions in power production have changed since 1901 and discusses from the practical point of view the advances that have been made in and the precautions that must be taken with modern electrical equipment. He deals especially with distribution, motors and control gear. The two essentials are continuity of service and output.—*Electrician,* Nov. 24, 1922.

Heat Applications and Material Handling

Tipping and Guiding of Vertical Skips.—G. W. SHARP.—The wear and tear and general condition of rope, guides, shaft timbering, winding engine and all that is accessory to the working of the skip, as well as the skip itself, depend so much upon the manner in which it is guided and tipped that practical improvement in this connection must be reflected in no small reduction of working costs. The author indicates the cause of excessive wear and tear and shows by what means improvement can be effected. Two subjects which are closely related—namely, the designing of tipping gear in such a way as to eliminate as far as possible shocks and excess strains and a description of an improved form of guiding slipper on skips—are the main points brought out by the author. He carefully worked out, illustrating his study with numerous diagrams, the static forces existing in the operation of tipping the skips, and, having made certain assumptions, has added to his calculations and drawings the effects of dynamic forces. This is a very comprehensive article, being about twenty-four pages long.—*Journal of the South African Institution of Engineers,* November, 1922.

Resistance Welding Transformers.—J. B. BORGADT.—The author discusses how modern designs of welding transformers tend to eliminate breakdowns, low efficiency and retarded production. The requirement of a good efficient welding transformer can be summed up as follows: Strong electrical and mechanical construction, good regulation, high efficiency, good cooling characteristics and low price.—*Welding Engineer,* December, 1922.

Electrophysics, Electrochemistry and Batteries

Small Oil-Engine Battery-Charging Sets.—The second of a series of three articles on this subject that commenced with the November issue. In the first article the author discussed standard non-automatic house-lighting equipment, defects of the old type of plant and improvements in more recent plants, describing the specific functions of the components of lighting sets. The second installment considers the regulation of current during charge, automatic control, the supply of constant voltage, semi-automatic and automatic sets, type of engines manufactured for this purpose and running cost. In the concluding installment examples of the complete apparatus will be described and illustrated in detail.—*Beama,* December, 1922.

Standard Cells of Concentric Form.—YUICHI ISHIBASHI.—A concentric standard cell is designed which is convenient for the insertion of materials and also for washing and drying the glass vessel. As for the voltage constancy, temperature coefficient and internal resistance of this form, there is no difference as compared with the H-form standard cell. The characteristics of recovering to the steady state in both forms of cells for the abrupt change of temperature were studied. Less diffusion lag and more rapid attainment to the apparent constant electromotive force were observed in the H-form cells, but the recovery of the initial electromotive force is more rapid in the case of the concentric cell. —*Bulletin 113 of Electrotechnical Laboratories,* Tokyo, Japan.

Telegraphy, Telephony, Radio and Signals

Radio Vacuum Tube.—H. M. FREEMAN and A. K. PHILLIPPI.—It is impossible to compare directly crystal and tube detectors because of their widely different characteristics and method of operation. Although they are apparently more complicated, the theory of operation of tubes is susceptible of more complete analysis than is that of crystal rectifiers. Such an analysis is simply and adequately given in an article by Mr. Freeman, while a study of crystal rectifiers is taken up by Mr. Phillippi in another article.—*Electric Journal,* November, 1922.

Effect of Local Conditions on Radio Direction-Finding Installations.—R. L. SMITH-ROSE and R. H. BARFIELD.—An account is given of the experiments carried out during the past year by a sub-committee of the Radio Research Board (England) on wireless direction finding. Experiments are described which provide quantitative data as regards the effects of metal work, coils, aërials, overhead wires and trees on a direction-finding set in their vicinity, and definite figures are given which show the extent in certain cases of errors produced by mountains and buildings.—*Electrician,* Dec. 8, 1922.

Miscellaneous

Influence of Temperature on Insulating Materials Used in Electrical Machinery. — ERNESTO VANNOTTI. — Laboratory tests, as well as the condition of machines which have been running a number of years, show that the temperatures that can be withstood without damage to the insulating materials are considerably higher than those prescribed by the international rules. The present values have probably been chosen so as to guard against too high temperatures caused by defective construction of certain parts of the machines. If exploring coils are placed suitably and with care at the points where overheating is most likely to occur, the value of the permissible temperature should be 10 per cent to 20 per cent higher than the rules permit, the author claims, in order to utilize fully the materials of construction used in the machinery.—*Journal of the A. I. E. E.,* December, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Batteries, Lead, Rate of Sulphation of.

A new method has been devised, based upon successive weighings of the positive or negative plates while immersed in the solutions to be tested, which are maintained at a constant temperature. The battery plates were immersed in the various electrolytes and any plate could be brought in the arm of a sensitive balance for weighing. The results showed considerable differences in the rates of sulphation (a) of plates made by various manufacturers, (b) produced by different concentrations of the acid solution, and (c) at different temperatures.—*G. W. Vinal, Bureau of Standards, Washington, D. C.*

Carborundum as Electrical Resistor Material.

Carborundum might be a good resistance material for high-temperature work since its decomposition temperature is around 4,000 deg. F. However, when it carries electric current hot spots of decomposition temperature seem to develop, although the temperature of the furnace itself may be only 2,500 deg. F. The life of such resistors has been found to be very short.—*J. L. McK. Yardley, Pittsburgh, Pa.*

Controller of Temperature or Pressure, with Pneumatic Switch.

A controller-recorder has been developed to operate a pneumatic switch, which in turn opens or closes an electric circuit. This arrangement may be used to start and to stop a motor-driven fan or blower, to operate the heating circuit in an enameling oven, etc. A time cam may be added to make the controller follow a desired program of temperature or pressure changes.—*Foxboro Company, Foxboro, Mass.*

Elevators, Multi-Voltage Control of.

Energy of several voltages is supplied to the elevator motors, usually through the medium of a double-armature balancer generator which floats on the line. Where 240-volt service is available, steps of 60, 120, 180 and 240 volts are obtained from the balancer. Power is delivered to the individual motors by five supply lines—the two outside ones from the source of supply and the three intermediate ones from the balancer. The advantages are economy of energy consumption, due to the practical elimination of resistances; smoothness and rapidity of acceleration and retardation; lower power demands, starting inrushes being greatly reduced, and simplified control equipment.—*W. H. Whitton, New York Edison Company.*

Fuel Metering, Electric, for Engine Tests

An automatic metering device for liquid fuels has been developed for use with the Sprague electric dynamometer. A fuel tank is placed on a platform scale with an electric contact on the beam. When the fuel reaches the value for which the poise is set the beam falls and closes an electric contact. This causes a bell to ring and operates a relay which automatically starts a stopwatch and a speed counter. The poise is then reset to a lower value, etc. From the data obtained the output, the speed and the fuel consumption per horsepower-hour can be computed.—*Sprague Electric Works, New York City.*

Iron, B-H Curve of, on Short Samples.

A short bar is clamped in a yoke which closes the magnetic circuit, and a distributed mmf. is applied in such a manner that it is used up bit by bit where produced, thus eliminating magnetic leakage. In order to know when this condition has been reached a secondary coil with soft-iron ends is so placed as to form a magnetic shunt around the sample. The mmf. is adjusted until a ballistic discharge through the test coil becomes zero. Tests by this method have been shown to agree quite closely with the results obtained on ring samples.—*Arthur Whitmore Smith, University of Michigan, Ann Arbor.*

Magneto, Cobalt Steel, Revolving Field.

Cobalt steel is four times as efficient for permanent magnets as the best tungsten steel. Therefore it has been possible to build an ignition magneto with a stationary armature. The only rotating elements are the solid steel magnet and the cam, which operates the stationary contact breaker. The weight of the new magneto is only about one-sixth of that of an ordinary magneto. For further details see the (London) *Electrician*, Vol. 89, page 443, Oct. 20, 1922.

Poles, Preservation of.

By forcing hot paraffin containing copper or arsenic salts into timbers under pressure the wood can be preserved from damage by shipworms and other destructive forms of life. The method of application is the same as that now used in treating timber with creosote.—*Paul Bartsch, Smithsonian Institution, Washington, D. C.*

[This discovery of a way to seal poison in wood promises complete protection against the ravages of termites, teredos, etc., and may become of great value in many branches of engineering where wood is employed.—EDITOR.]

Transformers, Spark-Over Tests on Coils in.

Tests were made on transformers of 30, 60 and 6,000 kva. rating connected to a high-tension line. Spark-overs between one of the line phases and the ground were produced at different distances from the transformers, and the resulting stresses in the transformer coils were measured. In the small transformers the maximum stress always was at the end coils, showing that a line spark-over produced a steep-front traveling wave. In the large transformer the location of the maximum stress depended essentially upon the distance of the spark-over from the transformer, thus indicating the presence of oscillations.—*Sigurd Rump, Baden, Switzerland.*

[This seems to indicate that in large transformers it is not sufficient to provide extra insulation on end coils only, as is the present practice.—EDITOR.]

Research in Progress

Core Losses.

A committee is at work to reduce the calculation of electrical core losses as well as of eddy-current losses in machines and conductors to a more rational and scientifically exact basis. Four phases of the work are now being conducted by four universities—Harvard, Washington (St. Louis), Missouri and Massachusetts Institute of Technology—and the General Electric Company, under the supervision of five members of the committee. A number of manufacturers are furnishing the services of their engineers and the facilities of their laboratories. The work has already resulted in a slight change in design of the standard induction motor which will decrease the core losses from 3 per cent to about 2¼ per cent without increase in cost.—*National Research Council Engineering Division, New York City.*

Insulators, Effect of Vibration Upon.

We have in view some experiments to determine the effect of vibration upon the mechanical and electrical strength of suspension-type insulators. The apparatus for making the test has been designed and built, but the actual work has not yet been started.—*R. J. C. Wood, Southern California Edison Company, Los Angeles, Cal.*

Magnetic Analysis.

A committee has been organized by the American Society for Testing Materials to study the magnetic properties of bodies, to correlate such magnetic properties with corresponding mechanical properties, and to develop suitable methods of testing for magnetic properties, with respect to commercial applications.

Surges on Transmission Line.

We are doing some research on the actual magnitude of high-voltage surges occurring in the Big Creek transmission lines, this being determined by the use of a photographic surge recorder which we have developed.—*R. J. C. Wood, Southern California Edison Company, Los Angeles, Cal.*

Suggestions for Research

Electromagnetism, Fundamental Relationships in.

An investigator who has to do with theoretical problems involving moving conductors, alternating fluxes, currents induced by rotation and pulsation, mechanical forces in the electromagnetic field, etc., is often handicapped by the lack of fundamental equations containing energy and work done. Usually the problem is reduced to a system of simultaneous equations involving only factors of energy, such as currents, voltages, fluxes, etc. In rational mechanics there are Lagrangian equations, Hamilton's principle, the law of least action, etc., which permit one to derive the entire system of equations of motion by taking partial derivatives of certain characteristic functions of the system. While Maxwell and others have shown a possibility of such a method in electromagnetism, much remains to be done to bring this method within the reach of those working out engineering problems involving electrical machinery and apparatus.

Flash-Over Voltage, Effect of Dampness and Dust Upon.

At 60 cycles the flash-over voltage is considerably lowered by the presence of water, dust, etc., on the surface. At very high frequencies the effect of these factors is very small, indicating a different nature of the phenomenon. This difference is of importance in view of the fact that insulators are often tested by high-frequency oscillating voltages. It would be of interest to establish a theory which would explain the difference in the behavior at different frequencies and give a relationship between the flash-over voltage and the frequency.

Generating Stations.

Research is urged in the following directions: Turbo-driven generators, (a) temperature limitations, (b) temperature detectors, (c) fire-fighting equipment, (d) closed-circuit ventilation; automatic water-power stations, excitation, auxiliaries, grounding of neutrals, maintenance.—*Electrical Apparatus Committee of the N. E. L. A.*

Illumination by Wires Exploded b Electrical Discharges.

In order to obtain high-temperature spectra, fine wires were instantly melted by electrical discharges. A large condenser, charged at 26 kv., was used, and some 30 gram-calories of energy were dissipated in one-hundred-thousandth of a second. Without losses the temperature of the wire vapor would have been about 300,000 deg. C. Actually the flash had an intrinsic intensity of light corresponding to a temperature of about 20,000 deg. C., or approximately one hundred times the intrinsic brilliancy of the sun. Many new and interesting phenomena were observed. For details see the *Astrophysical Journal*, January, 1920.—*J. A. Anderson, Mount Wilson Observatory, Pasadena, Cal*

[This method may prove to be useful for intermittent lights for lighthouses, for guiding airplanes at night and for long-distance optical signaling in general—EDITOR.]

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Six Months' N.E.L.A. Work

President Smith Reviews His First Half Year of Office—Division and Committee Achievements

ON the first of January the present administration of the National Electric Light Association entered upon the second half of its term of office, and President Frank W. Smith has taken advantage of this fact to pass the first six months of the association year in brief review. In the January *Bulletin* of the organization he refers to the ever-increasing scope of the work and the consequent growth of executive responsibility, summarizing a few of the activities and accomplishments that marked the latter part of 1922.

The public policy committee, under the chairmanship of Martin J. Insull, met twice in New York, on Sept. 21 and Dec. 5. Many of its members, including the chairman, are devoting much time and effort to constructive work besides delivering speeches and visiting conventions in all parts of the country.

The executive committee met in New York on Sept. 20 and Dec. 6, all the geographic divisions of the association being well represented, those attending including all four vice-presidents. At the last meeting thirty-eight men remained in continuous session for six hours.

Five geographic divisions held conventions, as did seven state associations, and in addition there were many group meetings. All the fourteen geographic divisions are either in the full swing of activity or have organization perfected and are getting under way.

The four national sections—Accounting, Commercial, Technical and Public Relations—held conferences in the latter part of June or the first part of July, and their committees have since assembled in different parts of the country. Interest and attendance have been unusually high.

Officers of the association or representatives from headquarters have attended every important meeting, wherever held.

Radio and Fuel

Radio sub-committees of both the public policy and the electrical apparatus committees are making progress in the handling of this important subject from different points of approach.

On inductive co-ordination, water-power development, customer ownership, relations with banks, merchandising policy, good-will advertising, membership and many other matters of primary importance the appropriate committees have all worked hard and their efforts are bearing fruit.

The financial affairs of the association are reported in very satisfactory condition.

With Nicholas F. Brady, president of the New York Edison Company, as chairman of the general convention committee, John W. Lieb as vice-chairman and Arthur Williams as chairman of the entertainment committee, President Smith foresees an excellent working out of details for the forty-sixth annual convention of the association, to be held in New York City next June.

Representative Bacharach Pushes His Bill

Representative Isaac Bacharach, whose determination to push his bill to limit the jurisdiction of the federal courts over public utility rate cases was referred to in last week's ELECTRICAL WORLD, is circulating an appeal to his colleagues in the House to support this measure. In his letter to them he says:

"This bill has been favorably indorsed by the Governors of the following states: Arkansas, Georgia, Illinois, Indiana, Louisiana, Mississippi, Missouri, Nebraska, Rhode Island, South Carolina, Wyoming, Delaware, Maine, Maryland, Vermont and Wisconsin. It has been also indorsed by the state regulatory commissions of the following states: Arizona, Colorado, Florida, Idaho, Kansas, Michigan, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, South Dakota, Tennessee, Utah, Virginia, West Virginia and Oklahoma.

"You no doubt have heard directly from either your Governor or your regulatory commission asking you to support this bill. Hearings on the bill were completed on June 8, and since that time nothing has been done in the matter.

"I am very anxious to have the bill reported to the House at this session of Congress if possible, and I am therefore writing to ask if you will not communicate with the chairman and members of the sub-committee having the bill in charge, expressing your favorable interest in it and asking them to report it to the full committee at the earliest possible date.

"Anything that you may do to aid in getting the bill reported out of committee so that it may be considered by the House at an early date will be very much appreciated."

Great Plant for Boulder

Doherty Interests Plan Huge Development on Artificial Lake in Colorado Mountains

WHAT is designed to be the largest steam plant for the generation of electricity ever built on an artificial body of water in the United States will, if plans just made public are carried through, be constructed four miles south of Boulder on the Denver-Boulder highway by the Denver Gas & Electric Light Company and the Western Light & Power Company, members of the Cities Service group of companies controlled by Henry L. Doherty & Company.

The project includes the purchase of the Boulder Lake, an artificial reservoir high in the mountains, which covers 128 acres, impounding approximately 78,000,000 cu. ft. of water. This lake will be enlarged to cover 380 acres and impound 280,000,000 cu. ft. of water.

An immediate expenditure of $4,000,000 for plant and equipment is purposed, and when the plant and transmission system are completed it is said that the cost will have reached $12,000,000. Present plans are for a generating capacity of 120,000 hp., the possible ultimate rating being put at 250,000 hp.

When the new plant is completed it will serve the cities of Denver, Boulder, Lafayette, Fort Collins, Greeley and all intermediate cities and surrounding towns, going as far north as Cheyenne, Wyo. The old plant at Lafayette will then be abandoned. Pulverized coal from the mines of the vicinity is to be used. Transmission will be at 100,000 volts. It is said that the plant will be ready to supply the larger cities in its territory early in 1924.

Commonwealth Edison Buys Parsons Turbine

The purchase of a 40,000-kw. Parsons turbo-generator by the Commonwealth Edison Company for use in the new Crawford Avenue station in Chicago was announced in that city this week. The set, purchased from C. A. Parsons & Company, Newcastle-on-Tyne, England, will operate at a throttle pressure of 550 lb., with a total steam temperature of 725 deg. F., and after passing through the high-pressure end of the turbine the steam will be reheated to the initial temperature. The turbine will be used in the new plant along with others mainly of American manufacture. The station is designed to have an ultimate capacity of 500,000 kw.

This is the second turbo-generator of Parsons manufacture that the Common-

wealth Edison Company has purchased, the first being a 25,000-kw. set bought in 1912 and installed in the Fisk Street station, which has operated satisfactorily. Sargent & Lundy of Chicago are engineers in charge of design, with Merz & McLellan of London acting as advisory engineers.

Idaho Companies Must Pay Irrigation Rebates

Complying with a special act of the last Legislature, the Idaho Public Utilities Commission has issued an order granting a rebate to all irrigation farmers in the state using electricity for pumping. The law exempts power companies furnishing power for irrigation from the payment of certain taxes, but requires them to rebate the entire amount of this exemption to the individual farmer users. The total rebate ordered by the commission amounts to $47,232.87, divided among four power companies.

Aftermath of "Loop" Decision in Wisconsin

A temporary injunction has been issued by the United States court in the western district of Wisconsin restraining the State Railroad Commission from changing a set of "emergency" rates put into effect by the Wisconsin-Minnesota Light & Power Company in Eau Claire, Menomonie and Chippewa Falls because of the now famous decision of the Wisconsin Supreme Court last June declaring the municipality the legal unit in fixing rates and forbidding the enforcement of uniform charges for all places on the company's "loop" system regardless of the distance from the source of supply. The commission is directed to show reason on Jan. 20 why the injunction should not be made permanent. The company in adopting these emergency rates contended that the old rates which the commission had ordered restored pending a complete revision are confiscatory.

Meanwhile about forty smaller cities which receive their power from the same source, but which are not involved in the case which went to the Supreme Court, are still paying for electricity at the price ordered by the Railroad Commission by the uniform rate method declared illegal.

Basing its action on the Supreme Court decision in the "loop" case, the city of La Crosse applied last week for an injunction forbidding the Wisconsin-Minnesota Light & Power Company from continuing to charge in that city the rates imposed previous to the decision cited. This plea has been denied in the local court, which holds that under the Supreme Court decision relief is to be extended only to municipalities which have duly taken exception to the commission order setting up the "loop" and have duly appealed for relief. The city of La Crosse was not a party to the original action and therefore, the court holds, is neither bound nor benefited by the vacation of the order.

Getting Artistic Lighting in Theaters

The methods of attaining artistic color lighting in motion-picture theatres and the production of realistic lighting effects on the legitimate stage were the topics discussed at a well-attended Illuminating Engineering Society meeting in New York on Jan. 11. The meeting was conducted by A. L. Powell of the Edison Lamp Works, and the main speakers were Sam Rothafel, managing director of the Capitol Theater, and Louis Hartman, lighting engineer for the David Belasco productions.

Methods for producing artistic color lighting with little scenery were described by Mr. Rothafel, who explained in detail how the lighting effects at the Capitol Theater are planned and executed. Mr. Hartman discussed the lighting of interior and exterior scenes, stressing the point that very often there is a tendency to use too much light.

Carolina-Tennessee Charter May Be Repealed

A bill has been introduced in the North Carolina Legislature by Senator Dillard which seeks to repeal the charter of the Carolina-Tennessee Power Company on the ground that the charter provisions are so sweeping that the company would acquire dominion over all the undeveloped water-power interests in North Carolina and other companies be shut out. Simultaneously with this legislative fight, in which politics is said to be involved, the Carolina-Tennessee Power Company has instituted suit against the Hiawassee Power Company over the ownership of 500 acres of land in Cherokee County, N. C., upon the possession of which, according to W. V. N. Powelson of New York, the president of the Carolina-Tennessee Power Company, depends the execution of that company's program of hydro-electric development, said to involve the expenditure of approximately $7,000,000 for dams, power plants and transmission system. The repeal of the company's charter would, of course, automatically end both the litigation and the Carolina-Tennessee Power Company's project; but if that company wins its suit and retains its charter, work, according to Mr. Powelson, will begin in sixty days after the verdict. In this case, however, the Hiawassee Power Company is considered certain to appeal to the Supreme Court of the state.

Both Mr. Powelson and H. F. Vanderventer of Knoxville, Tenn., president of the Hiawassee Power Company, are in Murphy, N. C., where the suit is to be heard. The charter of the Carolina-Tennessee Power Company was granted by the North Carolina Legislature in 1909, and its headquarters were to be in Cherokee County.

Investment Bankers Oppose Governor Smith

Disapproval of the legislative program recommended by Governor Smith of New York in his message to the Legislature, so far as this program relates to the abolition of the existing public service commission and the institution of municipal "home rule," has just been voiced in a report by the committee on public service securities adopted by the board of governors of the Investment Bankers' Association of America. This report says in part:

"The legislation recommended by Governor Smith will create a lack of confidence on the part of the large and small investor within and without the state, thereby seriously impairing the credit of utility companies, and accordingly, until such time as the policy of state-wide regulation is reaffirmed definitely, the expansion of utility service will be greatly retarded.

"For a great many years the policy of state-wide regulation of public utilities has been the established policy of the State of New York. In fact, New York was one of the first states to recognize this principle. It has been followed, as we know, very generally by other states throughout the country, advantageously in the public interest. Furthermore, recognizing the great advantages of judicial regulation, protection of the public interest and freedom from political influences, especially up-state, investors have freely placed funds in these utilities with all the risks attendant to these investments. When viewed in this light, the good faith and moral credit of the state is involved. Investors would not have continued so freely to support the much-needed expansion of utility services by investment in their securities had they expected these industries to be again subjected to the danger of political control and local regulation."

Cleveland's Fixture Market Shows Trend of Design

Displays of lighting fixtures and parts by about seventy manufacturers marked the fourth annual lighting equipment market held at the Hotel Winton in Cleveland this week, coincidentally with the annual convention of the Lighting Fixture Dealers' Society of America. Although there was only a small attendance of dealers from outside of the Cleveland territory, the exhibits of the manufacturers showed strikingly this year's tendencies in fixture design.

The "high spots" of the meetings of dealers held at the Hollenden Hotel proved to be the "demonstrations," or playlets, illustrating right and wrong ways to sell fixtures and the summary handling of piracy of designs. The strong economic position of the fixture dealer, the standardization of fixture-outlet boxes, the greater use of glassware in the new designs and carton packing were among the topics.

Transatlantic Conversation Nearly Here

Speeches Transmitted by Wireless Telephony from New York to England Are Plainly Heard There—Reciprocal Communication Planned in Near Future

A GREAT stride in intercontinental telephony was made last Sunday evening when officials of the American Telephone & Telegraph Company sent messages and made speeches which, by means of wireless equipment, were plainly heard by Guglielmo Marconi and British engineers at New Southgate, a London suburb. Scattered words and phrases have been heard across the ocean before, but this week hundreds of consecutive syllables were, according to cabled comments, heard with distinctness and little was lost.

The first message, containing about 240 words, was spoken by President H. B. Thayer of the American Telephone & Telegraph Company, at exactly 9 o'clock. Eleven minutes later a cable message was received saying that Mr. Thayer's message had been heard and understood. Vice-president John J. Carty then sent a wireless-telephone message, and at 10:10 o'clock this cablegram from Mr. Marconi arrived:

"I have just listened to your radiotelephonic messages, which I have heard distinctly, and congratulate you and all those connected with the research which has led to this achievement."

Route of the Messages

Mr. Thayer and Mr. Carty spoke from the offices of their company at 195 Broadway and used a telephone connected to the radio equipment at Rocky Point, Long Island, by a telephone circuit about 70 miles long, half of it being underground cable and half open wire, and containing telephone repeaters and equalizers of a type similar to those used on long-distance telephone lines.

The distance from Rocky Point to New Southgate is about 3,400 miles. Prior to the tests of Sunday evening other tests were made to measure the transparency of the atmosphere to radio messages over such great distances. Measurements were also made on the strength which the signals received in New Southgate must have in order to be clearly heard above the noise of static and interference from other radio stations.

Sending apparatus may be set up in England in the near future to make possible conversations by transoceanic radiophone, but months of research and development must elapse before the method can be brought into commercial use. The demonstration was only incidental to a prolonged series of tests undertaken for the purpose of obtaining the accurate information upon which practicable transoceanic telephony can eventually be founded.

Technical Features

The technical features of the communication involved a departure from previous practice in two respects—the use of 10-kw. power tubes and the elimination of carrier currents in transmission.

In the ordinary transmission the voice current, so to speak, is carried along by a carrier current, which usually contains about two-thirds the energy. The carrier current is used to polarize the receiver devices. If the carrier current is, say, 50,000 cycles, the voice current will fluctuate perhaps between 47,000 and 52,000, which necessitates the use of quite a wide ether transmission band.

In the new method twenty 10-kw. tubes are arranged with modulators and filters to radiate into the the ether about 100 kw., composed entirely of voice current. The modulating system is similar in principle to that used in wire telephony and consists of balancing tubes against each other in such a way as to balance out the carrier frequency and radiate the voice current.

JOHN J. CARTY
Vice-President American Telephone & Telegraph Company

THE experiments which we are now making represent some of the advances which have been made in the first half century of the telephone art, which is now drawing to a close. They belong to the golden age of communication, which has achieved the extension of the spoken word throughout both space and time. But this golden age has not yet ended, and when we contem plate the possibilities of the future we discover that it has only just begun. It is to the future that we must now turn our minds and direct our endeavors

—Statement from Mr. Carty.

Suppression of the carrier and one side band occurs directly after the speech currents come from the telephone line which brings them to the radio equipment. The line current modulates the output of a high-frequency oscillator by the balanced modulating equipment, which eliminates the carrier frequency. A filter is then used to suppress one side band, the other side band being applied to a multistage amplifier, the output of whose last stage is the 100-kw. power applied to the antenna. Thus the new method is improved so that a very narrow band in the ether is occupied in transmitting speech.

By the suppression of one of the two side bands it also becomes possible to transmit twice as many messages simultaneously as is now effected, a feature which will become increasingly important as the use of radio grows and especially at the longer wave lengths.

At the receiving end a local oscillator is used to replace the carrier current in rendering audible the received signals. The vacuum tubes used in the present test, while not the largest which have successfully withstood laboratory trial, are the largest that have thus far been applied to radio telephony, and are characterized by means for sealing large copper thimbles to glass in such manner as to hold the best obtainable vacuum.

The radio apparatus and system used in the test are the result of research and experimental work in the laboratories of the American Telephone & Telegraph Company and in the laboratories of the Radio Corporation of America and its associated companies.

General Electric's Broadcasting Heard Abroad

Vice-president Coolidge has received a letter from W. T. Meehan of the General Electric Company informing him that his Christmas address, which was broadcasted on Dec. 24, was heard in both Liverpool and London, as well as in every state in the Union.

Valuation of Alabama Power Company

President Thomas W. Martin of the Alabama Power Company has given out a statement at Birmingham saying that his company will welcome further investigation to get at the correct valuation of its property for tax purposes. Because of the public discussion of this matter, Governor Thomas A. Kilby in his message to the Legislature advised that it be gone into thoroughly by that body. The Governor holds to the opinion that the valuation placed upon the property holdings of the company in Alabama is very much under what it should be.

President Martin says: "The truth is the Governor has been imposed upon by men who have a political purpose to serve." He says further that there has been no indication on the part of his company that an application would be made to increase rates, as was asserted by Governer Kilby. On the contrary, the company has made substantial voluntary reductions affecting approximately twenty thousand customers.

For Radio Standardization

Forty Societies Unite in Movement—A. I. E. E. and Institute of Radio Engineers to Be Sponsors

A broad program of radio standardization was agreed upon at a meeting on Jan. 12 of representatives of forty radio trade associations and national engineering and scientific societies. The meeting was held in the Engineering Societies Building, New York City, at the call of the United States Bureau of Standards in co-operation with the American Engineering Standards Committee. Dr. F. C. Brown, acting director of the Bureau of Standards, presided, and about one hundred were present.

After full discussion the conference adopted resolutions providing:

(1) That standards for radio apparatus and service should be formulated.

(2) That a broadly representative national committee on radio standardization should be formed under the leadership of the Institute of Radio Engineers and the American Institute of Electrical Engineers, under the procedure of the American Engineering Standards Committee.

Specifications for quality and performance of receiving apparatus, nomenclature and methods of testing and of rating apparatus are to be included in the program.

Dr. J. H. Dellinger, chief of the Radio Laboratory of the Bureau of Standards, showed how the widespread interest in radio had brought with it an increasing demand for uniformity and dependability in radio service and apparatus. The lack of any such standardization had been brought to the attention of the Bureau of Standards by producer, distributor and consumer. There had not previously been a concerted movement to introduce standardization by joint action of all radio interests.

Sane Standardization Demanded

Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers, said:

"As every new field of industry passes out of the childhood stage, the need for standardization becomes evident. The main difficulties which at once arise and which emphasize the necessity for cautious procedure are the dangers of stagnation in an only partly developed art, a possible excessive monotony in the resulting product, and a diversion of the best brains from such a field.

"On the other hand, it is only by a reasonable amount of standardization along wise directions that gross abuses of public confidence can be avoided. As a typical instance, consider the objectionable nature of some of the so-called 'information' appearing on nameplates and in the advertisements of radio apparatus. We have seen 'static eliminators,' 'thousand-mile receivers,' 'twenty-plate condensers' and a score of other vague or misleading designations. The purchaser of radio sets and the dealers who handle them are all entitled to protection against this sort of loose description. Thus we are brought face to face with the necessity for sane standardization."

The following advisory committee was appointed to assist in the organization of the national committee and the necessary technical sub-committees: Major L. B. Bender, Dr. J. H. Dellinger, W. A. Fitzgerald, Dr. A. N. Goldsmith, J. V. L. Hogan, Commander S. C. Cooper, George H. Lewis, Max Lowenthal, Donald McNicol, L. T. Robinson, M. C. Rypinski, E. B. Warner and L. E. Whittemore.

Engineering Council Hails the Future

Washington Meeting of Federated Societies' Representatives Sees Great Possibilities Awaiting Technical Men in Public Service—Influence of the Body with Federal Government

FURTHER crystallization of the belief that engineers can render a real public service and that the Federated American Engineering Societies provides a workable medium through which they may unite in rendering it has resulted from the meeting in Washington on Jan. 11 and 12 of the American Engineering Council. The marked

GELASIO CAETANI

characteristics of this gathering were its desire to further international relationships among engineers, its accentuation of the need for engineering colleges to train their students to assume leadership in public affairs, and its endeavors to promote relief in the Patent Office, adequate personnel for the Federal Power Commission, a more comprehensive policy with respect to topographic maps and a higher salary scale for technical men in the federal service. Strongly worded resolutions on these points were adopted.

Co-operation on an important scale is to be undertaken with the Forest Service in the matter of reforestation and with the Department of Commerce in the matter of types of government contracts. It was announced that the societies had all but concluded arrangements to undertake two new surveys which will be entirely comparable with those made on waste in industry and on the twelve-hour shift.

Dean Mortimer E. Cooley was re-elected to the presidency of the federation and J. Parke Channing was re-elected a vice-president. Calvert Townley, Philip N. Moore and Gardner S. Williams were elected as new vice-presidents. Mr. Williams was selected to fill out the unexpired portion of the term of Dean D. S. Kimball. H. E. Howe was re-elected treasurer.

One of the most interesting features of the meeting was the banquet of Jan. 11, which was attended by ninety-one guests. On that occasion the principal address was made by Ambassador Caetani of Italy, who is both a mining and a civil engineer of distinction. Extracts from his speech are printed under a separate heading. At this banquet Calvin W. Rice, secretary of the American Society of Mechanical Engineers, reported on his South American trip and urged an interchange of engineering education between the United States and the countries of South America. Elmer A. Sperry, the inventor of the gyro-compass and ship stabilizers, told of the progress being made by the engineering professions in Japan.

In the course of the business sessions some dissatisfaction was voiced with the conduct of the affairs of the Federated American Engineering Societies. The point was made that member societies had too little voice in what was being done and fear was expressed that an effort might be made to make of the federation a super-society. It was pointed out by President Cooley and by L. W. Wallace, the executive secretary, that every effort had been made to conduct the federation so that it would be a sort of House of Representatives—highly responsible to and in no way dominating constituencies. The difficulties were ironed out, and the general discussion by members of the council indicated a complete sympathy with the broad purposes of the federation, though it also emphasized the need of devising every means possible to acquaint the individual engineer as well as the member societies with the work completed and problems to be undertaken.

President Cooley in his address said:

"I am more than ever convinced, after fifteen months of service in the federation, that the opportunities for the engineering profession to do something remarkable in this world are very great. They are so vast that we cannot comprehend them. We do not think of them, we are so busy in our field, we do not even dream of them, and we do

not dream of what we can do or what the opportunities really are."

INFLUENCE AT WASHINGTON

In the course of his remarks L. W. Wallace, the executive secretary, said:

"The Federated American Engineering Societies has become firmly established in the official mind of Washington as an influential and constructive agency that is working in the interest of the public and without any ulterior motive. I shall name only two facts that support my statement. To date the Federated American Engineering Societies has conducted two major investigations, namely, those on waste in industry and the twelve-hour shift in American industry. The introduction to the former was written by the Secretary of Commerce; the introduction to the latter was drafted by the President of the United States."

Mr. Wallace mentioned many instances of the high esteem in which the federation is held by engineers and citizens both at home and abroad, among them the fact that the government of Czechoslovakia had asked permission to reprint the report on waste in industry. This reprint will be in the German language and will be distributed in Germany and Austria as well as Czechoslovakia.

Caetani to Engineers

Italian Ambassador Bears Good Will of His Nation to the Technical Men of America

A NOTEWORTHY feature of last week's meeting of the American Engineering Council at Washington was the banquet on Thursday evening, at which the new Ambassador from Italy, Gelasio Caetani, was the principal guest. Ambassador Caetani is himself a civil and mining engineer, a graduate of the School of Mines at Columbia University, and spent thirteen years in the practice of his profession in this country. In responding to a toast the Ambassador dwelt on the good relations between Italy and the United States and the way in which in some directions the natural bent of the two countries and the respective characteristics of their peoples could complement each other. He said in part:

"I judge that many of the colleagues present at this banquet have followed in life most disparate occupations which often had little to do with engineering. Such has been my personal experience during the agitated years since the beginning of the war. Well, gentlemen, we can say that in each and every occupation we have felt and thought and acted chiefly as engineers.

"Some have made the remark in criticism that engineers lack political intuition and ability. I would answer that a larger dose of logic and positiveness applied to politics would bring great advantages to public affairs.

Paying a tribute to the qualities of the Italian workman, the Ambassador continued:

"Specialization of Italian labor will bring great advantages to the large engineering, industrial and agricultural enterprises which are still to be achieved in the United States. Much, however, is still to be done in Italy itself; its resources are far from being fully developed, and there are many opportunities for American capital, machinery and technical organization to be usefully applied in Italy.

"The electrical industry in our country has made rapid strides, and as to percentage of utilized water power, Italy ranks, I believe, foremost in the world. Electricity is our 'white coal,' and at the present day its use results in an economy of about two billion lire, otherwise necessarily spent on fuel imports.

ELECTRICAL DEVELOPMENT IN ITALY

"In 1898 the electrical energy developed in Italy amounted only to 87,000 kw.; it increased to 426,000 kw. in 1908, to 1,240,000 kw. in 1918, and power plants for some other 1,000,000 kw. are planned or under construction. About 800,000 kw. is still to be developed.

"On the Tirso, in Sardegna, a reservoir with 416,000,000 cu.m. of capacity is being constructed. It will be the second largest in the world, ranging immediately after the Assuan Dam, and will develop 50,000,000 kw.-hr. and irrigate 60,000 acres of land.

"The newly redeemed provinces in northern Italy are virgin ground for hydro-electric engineering because Austria, for political reasons, prevented the development of the power plants which could only have an outlet toward Italy.

"In the Trentino a reservoir is to be constructed on the Noce torrent of 180,000,000 cu.m. capacity. The dam, 400 ft. high, will be practically a concrete wedge driven in a mountain gully, measuring less than 60 ft. in width at the base and only 100 ft. wide at 300 ft. above the bottom. In southern Italy the large reservoir in construction on the Sila mountain will develop over 110,000 kw. and irrigate large tracts of fertile land.

"Another interesting plan which is gradually being carried through is to connect the northern power plants, fed by the summer streams of the Alps, with those of central Italy, where water is plentiful in winter and rather poor in summer, by a network of high-tension lines and by standardization of voltage to obtain a better seasonal compensation than could be secured by the use of even very large reservoirs.

"Railroads are to be electrified and telegraphs and telephones are to be reorganized and then gradually handed over to private enterprises. Experience has proved that state administration of industrial concerns ends always in a financial and technical failure.

"There are most remarkable possibilities for increasing the commercial and industrial exchange between Italy and the United States. Each of our countries is especially fit for the production of certain kinds of products. You have the raw materials, you produce wheat cheaper than we can, you have the means and the capacity to build machinery in series. We have arts and products of our own and skilled and intelligent workmen to turn out to better advantage any material in which labor accounts for a large percentage of the cost.

"For each item there exists a difference in cost between Italy and America which, like a difference in hydraulic level, causes merchandise to flow from one country to the other and creates a circulation of products; that is, commercial and economic intercourse. These differences are a vital, indispensable requisite for the prosperity of both countries as they cause motion, and there is no life without motion.

"Intercourse between our young students, who in a few years will be the active men of our countries, will be a powerful factor in reaching the principal and ultimate aim I will have in view in carrying out my duty as Ambassador; that is, to strengthen the bonds of friendship and esteem between Italy and the United States."

Wider Distribution Planned by Niagara & Lockport

The Niagara, Lockport & Ontario Power Company of Buffalo has purchased the stock of the Bradford (N. Y.) Electric Company, which in turn owns all the outstanding stock of the Olean Electric Light & Power Company, and has started to build a double-circuit 110,000-volt transmission line to Olean for supplying Niagara power in the Olean-Bradford district. By the end of this year the company expects to have 110,000-volt duplicate circuits paralleling its 60,000-volt transmission system, with three transformer stations stepping down the voltage from 110,000 to 60,000. This will permit transmitting the "long-haul" power at the higher tension and distributing it through the existing system—an economical method which leaves the present investment intact and avoids the installation of costly 110,000-volt auxiliary equipment at each point of use.

A new 110,000-volt double-circuit line from Dunkirk to Jamestown is under way to connect with the existing transmission system, and there will be a transformer and frequency-changer station at the boundary between Jamestown and Falconer, with an initial 15,000-kva. transformer capacity and 6,000-kva. frequency-changer capacity, suitable for eventual increase to 30,000 kva. and 16,000 kva., respectively, for the distribution of Niagara power in the Jamestown district. Another new substation will soon be started at Olean with 10,000 kva. frequency-changer capacity and 15,000-kva., 110,000-volt transformer capacity, which can ultimately be raised to 20,000 kva. and 30,000 kva., respectively. This station will distribute Niagara power in Olean-Bradford district at 25 cycles and 60 cycles.

Next A. I. E. E. Program

Proceedings at Midwinter Convention Will Be of Varied Nature and Sustained Interest

FOR the eleventh midwinter convention of the American Institute of Electrical Engineers, to be held in the Engineering Societies Building, New York City, on Feb. 14-17, the meetings and papers committee, in co-operation with the convention committee, has prepared a tentative program including not only a number of papers of special merit but also several instructive and entertaining features.

On Wednesday, the opening day, the morning will be devoted to the registration of members and guests and to meetings of the various A. I. E. E. committees. The first technical session will be held in the afternoon, the program being under the auspices of the transmission and distribution committee. The Wednesday evening session, as already announced in the ELECTRICAL WORLD, will consist of a joint meeting with the Chicago Section by the use of telephone connections and loud speakers. Two papers will be delivered by means of the loud speakers, one being presented at New York and the other at Chicago. Lantern-slide illustrations will be shown at both places and a joint discussion will follow. After the telephone meeting an illustrated lecture will be delivered by William B. Potter, who has recently spent several months investigating the electric railway systems of Europe.

On Thursday the morning session will be devoted to a group of papers on miscellaneous subjects, and in the afternoon a technical session under the auspices of the telephone and telegraph committee will be held. In the evening there will be a smoker under the auspices of the New York Section of the A. I. E. E., at which motion pictures showing a new development in speech transmission will be exhibited.

The session on Friday morning will be under the auspices of the electrophysics committee, and on Friday afternoon the final technical session of the convention will be held under the auspices of the measurements and instruments committee. On Friday evening the annual dinner-dance will be held, and Saturday morning will be devoted to visits of inspection to places of engineering interest in and about New York City.

Plans for the Pacific Coast Convention of A. I. E. E.

Convention committees have been appointed and plans are well under way for the Pacific Coast convention of the American Institute of Electrical Engineers to be held under the auspices of the San Francisco Section, beginning on Sept. 25. The place of the meeting has been tentatively set as Del Monte, Cal. In the program will be featured the hydro-electric developments of the West and the recent accomplishments in high-voltage transmission, and it will contain papers on other timely subjects designed to stimulate wide interest and attract a large attendance. Professor Harris J. Ryan of Stanford University has been named convention chairman and Robert Sibley vice-chairman.

Army Bill Carries $7,000,000 More for Muscle Shoals

The War Department appropriation bill just reported out from committee carries an appropriation of $6,998,800 for the Muscle Shoals project. In addition, it gives contract authorization for $10,501,200. These sums are intended to provide for the completion of the dam and the installation of eight power units complete. This authorization makes it possible to let contracts for the lock gates, the gates of the dam and such metal work as requires time to fabricate.

For 1926 Technical Meet

International Engineering Congress Planned for Sesqui-Centennial Fair at Philadelphia

A MOVEMENT to hold a World Congress of Engineers in 1926 at the time of the sesqui-centennial celebration in Philadelphia was initiated by the Engineers' Club of that city in December, 1921, and an invitation at that time was extended to the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society for Testing Materials. Each was requested to appoint two representatives to meet with a committee of the Engineers' Club of Philadelphia to formulate a plan for such a world congress.

Subsequently a board of management was appointed as follows: A. S. C. E., George S. Webster, Richard L. Humphrey; A. I. M. and M. E., J. Vipond Davies, Charles F. Rand; A. S. M. E., James Hartness, D. Robert Yarnall; A. I. E. E., A. E. Kennelly, Charles E. Skinner; Federated American Engineering Societies, J. Parke Channing, L. P. Alford; Engineers' Club of Philadelphia, W. C. L. Eglin, Charles E. Billin. Richard L. Humphrey was made chairman of the committee on plan and scope, of which the other members are Charles F. Rand, James Hartness, A. E. Kennelly, J. Parke Channing and W. C. L. Eglin. This

Tentative Program of Midwinter Convention, A. I. E. E.

WEDNESDAY, FEB. 14

Technical Session, 2.30 *p.m.*—Report of transmission and distribution committee, E. B. Meyer, Public Service Electric Company, Newark, N. J.; "Apparent Dielectric Strength of Cables," R. J. Wiseman, Okonite Company, Passaic, N. J.; "Short-Circuit Currents in Networks," O. R. Schurig, General Electric Company; "Qualitative Analysis of Transmission Lines," H. Goodwin, Jr., Sanderson & Porter, New York; "The Heavisidion," Vladimir Karapetoff, Cornell University; "Cable Testing and Maintenance," H. S. Phelps and E. D. Tanzer, Philadelphia Electric Company.

New York-Chicago Joint Session, 8.30 *p.m.*—"Public Address Systems," G. K. Thompson and J. P. Maxfield, American Telephone & Telegraph Company; "Use of Public Address Systems with Telephone Lines," W. H. Martin, American Telephone & Telegraph Company; lecture, "Observations on Electric Railway Practice," William B. Potter, General Electric Company.

THURSDAY, FEB. 15

Technical Session, 10.30 *a.m.*—"Automatic Train-Control Problems," E. J. Blake, Gould Coupler Company, Depew, N. Y.; "Application and Economics of Automatic Railway Substations," L. D. Bale, Cleveland Railway Company; "Single-Phase Regeneration for Series Commutator Motors," L. J. Hibbard, Westinghouse Electric & Manufacturing Company; "The Blondelion," Vladimir Karapetoff, Cornell University; "Transients in Electrical Machinery," W. V. Lyon, Massachusetts Institute of Technology; "1922 Developments in Auto-Valve Lightning Arresters," A. L. Atherton, Westinghouse Electric & Manufacturing Company.

Technical Session, 2.30 *p.m.* — "Telephone Transmission Over Long Cables," A. B. Clark, American Telephone & Telegraph Company; "Machine Switching," E. B. Craft, Western Electric Company, L. F. Morehouse, American Telephone & Telegraph Company, and H. P. Charlesworth, American Telephone & Telegraph Company; "Wind Shielding Between Conductors," F. J. Howe, Western Union Telegraph Company; "Wave Antennas," Harold H. Beverage, Chester W. Rice and Edward W. Kellogg, General Electric Company; "Theory of Electric Filter Circuits," L. J. Peters, University of Wisconsin; "Diaphragmless Microphone, for Radio Broadcasting," Philips Thomas, Westinghouse Electric & Manufacturing Company.

Smoker, 8.30 *p.m.* — Motion pictures showing new method of speech transmission.

FRIDAY, FEB. 16

Technical Session, 10.30 *a.m.* — "Dissymmetrical Electrical Networks," A. E. Kennelly, Harvard University; "New Equation for Static Characteristics of Electrical Arcs," W. B. Nottingham, Westfield, N. J.; "Radiation from Transmission Lines," Charles Manneback, Massachusetts Institute of Technology; "Electromagnetic Forces," Carl Hering, Philadelphia; "Physical Interpretation of Complex Angles and Their Functions," A. Boyajian, General Electric Company; "Permeability," T. Spooner, Westinghouse Electric & Manufacturing Company.

Technical Session, 2.30 *p.m.*—"Application and Limitation of Thermocouples for Measuring Temperature," I. B. Smith, Leeds & Northrup Company, Philadelphia; "Measurement of Power in Polyphase Circuits," C. Fortescue, Westinghouse Electric & Manufacturing Company; "Kilovolt-Ampere Demand Measurement," H. C. Fryer, Union Gas & Electric Company, Cincinnati; "Expansion of Oscillography by Portable Instrument," J. W. Legg, Westinghouse Electric & Manufacturing Company; "Measurement of Transients," F. Terman, Leland Stanford University; "Balance Methods in Alternating-Current Measurement," P. A. Borden, Hydro-Electric Power Commission, Toronto.

committee prepared for a conference, which was held in New York City on Tuesday of last week.

At this conference twenty-five or thirty leading engineers from the different engineering organizations expressed their ideas on the scope of the congress, the relation of meetings of engineering societies to the sessions of such a congress and cognate topics. It was brought out that the proposed meeting would be another step toward bringing the engineers of the world closer together, taking up the threads of contact broken by the war and fostering a better understanding of the relation of the engineer not only to the technical problems of the world but to the reconstruction of present-day civilization. Emphasis, it was generally agreed, should, in the program prepared, be laid on these broader relations of the engineer to the public rather than on the presentation of a large number of technical papers.

It was asserted by several of the engineers at the conference that an opportunity was afforded to make engineers abroad better acquainted with the actual engineering achievements and accomplishments in this country by a tour of industrial cities. Those contributing especially to the discussion were A. M. Hunt, H. Foster Bain, Henry A. Lardner, Fred Lavis, A. R. Ledoux, John W. Lieb, Elmer A. Sperry, Mortimer E. Cooley, Charles F. Rand, F. M. Feiker, C. O. Mailloux and Clayton H. Sharp.

Program Adopted by Western Electrical Inspectors

The recodification of the National Electrical Code, the 600-watt rule and the identification of fuses by color will be some of the subjects discussed at the eighteenth annual meeting of the Western Association of Electrical Inspectors, to be held at the Hotel Sherman, Chicago, on Jan. 23, 24 and 25. The tentative program is as follows:

TUESDAY, JAN. 23

Morning.—President's address, reports of officers, report of committee on devices and materials (A. R. Small).

Afternoon.—Reports of sub-committees on polarization of wires (A. R. Small), identification of fuses by color (C. A. Bates), protection of armored cable through floors (A. R. Small), switchboards (B. H. Glover), 400-600-amp. fuses (A. R. Small), cabinets (A. R. Small), 600-watt sockets (C. A. Bates), isolated lighting plants (A. R. Small) and exposed live parts (Dr. M. G. Lloyd); reports of committees on fixtures, heaters, signs and lamps (J. C. Forsyth), generating stations and substations (K. W. Adkins) and grounding (W. H. Blood, Jr.).

WEDNESDAY, JAN. 24

Morning.—Report of committee on industrial applications (G. S. Lawler), reports of sub-committees on protection of motors (G. S. Lawler), equipment in dusty places (F. F. Burroughs), 2,500-volt motors (G. S. Lawler), varnished-cloth insulation for motor leads (R. B. Shepherd) and transformers for electric furnaces (J. C. Forsyth).

Afternoon.—Reports of committees on outside wiring, building supply and services (Dr. M. G. Lloyd) and signal systems, wireless and lighting (Thomas H. Day).

THURSDAY, JAN. 25

Morning.—Reports of committees on theaters, motion pictures and places of public assembly (Washington Devereaux) and wiring standards (A. P. Denton); report of sub-committee on 660-watt rule (A. P. Denton and A. R. Small).

Afternoon.—Reports of sub-committees on lead-covered wires in conduit (A. P. Denton), size and number of wires in conduit (Arthur L. Abbott) and extensions to wiring in fireproof buildings (A. P. Denton); report of committee on recodification of National Electrical Code (Dana Pierce); election of officers.

Friday, Jan. 26, will be devoted to inspection tours, in charge of F. G. Waldenfels.

F. W. Smith Prize in N.E.L.A. Educational Courses

President Frank W. Smith of the National Electric Light Association has offered an annual prize of $100 in gold, open for competition to Class B, Class E and Class G members of the association who are subscribers to any of its educational courses, who have been in the continuous employ of a company, firm or individual member of the association during their period of study, and who have completed within the specified time and preceding the first day of January of the year in which each national convention is held, with a grade mark of not less than 90 per cent, the merchandise sales course, lighting sales course, power sales course, practical electricity course, commercial engineering course, elementary accounting course or advanced accounting course of the association.

Applicants for the award must submit a statement reciting in detail in what manner and to what extent the course has benefited the individual or company, or both. This statement must include such facts as increased amount of work accomplished, increased responsibilities assumed, promotions received or increase in salary or income resulting from the study of the course and any other facts which, in the judgment of the applicant, may be evidence to the judges of tangible benefits received.

This prize is to be awarded annually at each national convention of the association to the competitor who, in the judgment of a majority of the members of the committees on education of the Commercial and Accounting Sections, has received the most benefit from any one of the courses.

Montreal's Rates for Lighting One-Third Those of 1908

A new rate for electric lighting just announced by the Montreal Light, Heat & Power Consolidated represents a reduction of 11.4 per cent from the present rate and, according to the company, will mean an annual saving of upward of $300,000 to consumers. The reduction is from 4.8 cents per kilowatt-hour (6 cents with a discount of 20 per cent) to 4.25 cents per kilowatt-hour (5 cents with a discount of 15 per cent). This is one of the cheapest rates on the continent and is exactly one-third the price charged in 1908, fifteen years ago.

To gain the benefit of the new rate consumers must sign five-year contracts, a system now in force. The reduced rate will go into effect immediately after the contract is signed.

Brief News Notes

Promoting Widespread Ownership.—The stockholders of the Northern New York Utilities, Inc., Watertown, N. Y., have voted to increase the number of shares of common stock from 40,000 to 160,000, decreasing the par value of each share from $100 to $25. This change has been made to render the stock more salable and is in line with the company's policy of broadening the field of individual stock ownership.

Another Iowa Utility Purchase.—The Iowa Gas & Electric Company, Washington, Iowa, has purchased the Louisa County Power Company, Columbus Junction. The Louisa County Power Company has a capacity of 175 kw. and serves Columbus City, Columbus Junction, Cotter, Letts and Grandview. This will bring the number of towns served by the Iowa Gas & Electric Company up to twenty-one.

Sand Springs Plant to Double Capacity.—The Sand Springs Power, Light & Water Company, which supplies electricity to Sand Springs, Tulsa and a number of other towns in Oklahoma, announces that it will almost double its power plant in 1923. The company now operates a plant at Sand Springs rated at 15,000 kva. An order has just been placed for an additional 12,000-kva. steam turbine, to be delivered early in the spring.

Flood Destroys Dam and Transformers.—The concrete dam of the Baker County Power Company on Notchaway River, 10 miles from Newton, Ga., was almost totally washed away on the night of Jan. 6, causing a loss of approximately $75,000. This company furnishes energy to the towns of Camilla, Doerun, Newton, Sale City and Moultrie. Two large transformers were lost, though the power house and most of the equipment remain intact. Repair work will start immediately.

New York-Ontario Power Company Seeks Rights.—The International Joint Commission will hold a hearing in New York on Feb. 12 at which it will take testimony in regard to the application of the New York-Ontario Power Company for rights covering a certain amount of water to be taken through the South Channel of the St. Lawrence at Waddington, N. Y. The company has applied to the Federal Power Commission for a preliminary permit covering this proposed utilization of water, but, as in the case of similar applications, it is being held to await the settlement of the whole St. Lawrence matter.

Wadsworth, Ohio, Gives Up Municipal Plant.—The municipal electric plant operated by the city of Wadsworth, Ohio, for several years is to be superseded by a contract with the Northern Ohio Traction & Light Company to sell to the city all the energy

it needs for lighting purposes. The contract involves the extension to Wadsworth of the company's 22,000-volt line from Barberton, 8 miles distant. Under the agreement made the city will be able to sell energy for 3 or 9 cents per kilowatt-hour. It has been charging 10 cents for the energy generated in its plant, and notwithstanding this figures show a loss of approximately $14,000 in 1921.

Third Report of Committee on Inductive Co-ordination.—The third report of the joint general committee of the N. E. L. A. and the Bell Telephone System on the physical relations between electrical supply and signal systems has just been issued. It embodies the detailed practices for the inductive coordination of supply and signal systems, which are based on the principles contained in the second report, printed in the ELECTRICAL WORLD of May 20, 1922. This second report is reprinted in the present edition in order that the principles and practices together may form a working guide in consecutive order. Copies of the reports in addition to those already mailed may be had by member companies on application to N. E. L. A. headquarters.

De Forest Aids Radio Work at Yale.—Dr. Lee de Forest has, it is announced by the Yale Engineering Association, undertaken to establish a library on radio telegraphy and telephony at Sheffield Scientific School and has made a first donation of $1,000 toward this end. The Sheffield school is one of the leaders in radio instruction and research work. Dr. de Forest has also donated $1,200 to defray the expense of an advanced course in radio engineering. Lectures will be given this year early in the second term by Commander S. C. Hooper, U. S. A., Gen G. O. Squier, U. S. A., G. A. Campbell and Lloyd Espenschied of the American Telephone & Telegraph Company, Dr. A. W. Hull of the General Electric Company, Prof. John Morecroft of Columbia University and Dr. L. E. Whittemore of the Bureau of Standards.

A Big Colorado River Scheme.—A bold engineering scheme on the Colorado River is proposed by the Colorado River Syndicate, said to have the backing of New York and Philadelphia bankers. W. G. Clark is the consulting engineer. The plan is to build a dam 1,100 ft. high at Boulder Canyon or Black Canyon. This will mean the backing up of water into the lower edge of Grand Canyon National Park and the flooding of a number of small towns. An unusual feature of the plan is that the power house is not to be built at the dam but at the end of a 25-mile tunnel which is to be driven through the hard rock of the region and to carry an average flow of 12,500 second-feet. The scheme also involves the construction of a dam at Bull's Head Rock. This smaller development is to provide power for the construction of the larger project. The proposal is regarded with sufficient seriousness by the Federal Power Commission to insure an investigation of its possibilities.

Eau Claire (Wis.) and Rochester (Minn.) Municipal Plants Face Predicament.—Representatives of the Wisconsin-Minnesota Light & Power Company of Eau Claire, Wis., have placed a proposal for a hig-tension line before the City Council. That city is faced with the problem of either spending a large sum on its municipal electric light plant for extensions and improvements or purchasing its future supply of light and power from a private corporation, using its present plant for emergency purposes. The city of Rochester, Minn., is reported to be in a similar predicament, having to choose between spending $75,000 for an additional hydro-electric unit and connecting up with the Wisconsin-Minnesota Light & Power Company at Red Wing, Minn.

Associations and Societies

Electric Power Club.—The annual meeting of the Electric Power Club has been set for June 11 to June 14 and will be held at The Homestead, Hot Springs, Va.

Pacific Coast Electrical Association.—The annual convention of this association will be held at the Fairmount Hotel, San Francisco, on June 19-22. The program has not been announced.

Michigan Electric Light Association.—The place and date for the tenth annual meeting of this body have already been set, and it will be held in the Hotel Pantlind, Grand Rapids, on Aug. 28-30. Among the topics selected for discussion are uniform methods of accounting, safety in radio installation, development of water power and economy in operation.

Iowa Engineering Society.—At the mechanical-electrical session of the convention of this society at Des Moines next week John M. Drabelle, Iowa Railway & Light Company, Cedar Rapids, will give a paper on "Arch and Furnace Design for Iowa Fuel," and Milton W. Arrowwood of Chicago one on "Efficient Use of Pulverized Fuel." The session will be held on Wednesday, Jan. 24.

Great Lakes Division Technical Committees, N. E. L. A., Meet.—The Technical Section of the Great Lakes Geographic Division of the National Electric Light Association met at the Hotel LaSalle in Chicago on Wednesday, Thursday and Friday of last week for the discussion of technical problems in that territory. Nearly a hundred men from the four states in the division, in which the committee organizations are virtually identical with those of the National Technical Section, were present.

Pennsylvania Electric Association.—A meeting of the geographic sections committee of this association will be held at Pittsburgh on Jan. 23. Topics are: "Aërial Cables," by W. C. Hayman, General Electric Company; "Meters," by Orville Buys, Duquesne Light Company; "Transformers," by M. W. De Merit, West Penn Power Company, and "Training Employees," by J. J. Dougherty, Duquesne Light Company. Brief talks on safety and education will also be made, the latter by A. N. Cartwright, West Penn Power Company.

Illumination Lectures for Chicago Architects.—A series of lectures on the approved methods of illumination will be given to architects and architectural engineers from Jan. 22 to Jan. 26 under the joint auspices of the Chicago Section of the Illuminating Engineering Society and the Armour Institute of Technology. This is the first series of lectures which will be promoted in New York, Boston and Philadelphia with the view of assisting architects in their illuminating problems. These lectures will be held in the lecture rooms of the Western Society of Engineers. The tuition fee for the course will be $10. The lecturers will be Ward Harrison, A. L. Arenberg, Prof. E. H. Freeman, A. J. Sweet, Prof. H. H. Higbie, S. G. Hibben, A. L. Powell, J. L. Stair, Norman Macbeth, M. Luckiesh, Otis L. Johnson and George Ainsworth.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society—Des Moines, Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14. General meeting, Hot Springs, Va., March 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 W. 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Society of Mechanical Engineers—Montreal, March 28-31. C. W. Rice, 29 W. 39th St., New York.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Commission Rulings

Proper Proportion of Stocks and Bonds.—The issue of securities which would make the total par value of bonds equal approximately 80 per cent of the securities outstanding and the stock 20 per cent was disapproved by the New Jersey Board of Public Utility Commissioners in passing on applications from the Commonwealth Electric Company of Summit and other companies. Were the proportions changed to 70 per cent and 30 per cent respectively, the commission intimated that approval would be given.

Common Stock Should Not Be Issued Under Par.—In granting the Penobscot Power Company permission to capitalize a hydro-electric undertaking by issuing stock and bonds in the proportion of one to two, the Maine Public Utilities Commission said: "It has been the policy of this commission to insist that common stock should be issued at not less than par. The price which the bonds will bring on the market depends primarily upon certain things, among which are the security and the rate of interest and the availability of capital seeking investment at the time such capital issues are offered. Ordinarily it is as well to permit the issue at a discount of bonds carrying a normal rate of interest as to make the rate higher in order to command par for the bonds, but if that is done the sum of the stock and bonds so issued will exceed the total amount of money immediately realized, and the absorption of the difference properly becomes a problem for the stockholders as the corporation proceeds. We believe that the price at which it is proposed to sell these bonds is reasonable under all the circumstances, but we shall provide in our decree that the discount on the bonds be amortized during the life of the bonds."

Why Federal Income Tax Does Not Belong in Operating Expenses.—In fixing the rate base for the Pacific Gas & Electric Company the California Railroad Commission excluded the federal income tax from operating expenses, saying: "An income tax has been imposed by the federal government since this commission acquired jurisdiction over power utilities and established what it considered a fair rate of return. This tax is now 12½ per cent of net revenue after bond interest, depreciation and certain other smaller deductions, which in this case is equivalent to approximately four-tenths of 1 per cent on the reasonable rate base found herein. If this tax were allowed as a part of the return to the company, a return of 8.4 per cent at the present time would be approximately equivalent to the 8 per cent allowed in 1913. On the other hand, the company is larger, has a more diversified business and has, by absorption, eliminated the prospect of no small amount of competition. More than ever before the production and distribution of electrical energy is recognized as an essential and basic industry, and the confidence of the investing public in the soundness of state regulation is becoming more firmly established. The benefits to the investor of supervision of financial operations and the encouragement by large utilities of 'customer ownership' have contributed to a wider distribution of securities and a broader market for new issues. Under such conditions a utility should be able to finance itself much more cheaply than before, and we believe that this factor may fairly and safely be considered as offsetting the effect of the federal income tax and of the increase in interest rates during the period of high prices in so far as such interest rates have affected the operations of this company. A return of 8 per cent upon the estimated reasonable investment will therefore be allowed in the present proceeding."

Recent Court Decisions

Whether Fatal Accident in Trying to Safeguard Children Involved Contributory Negligence Is for Jury to Decide.—In attempting to move a fallen electric wire to a safe distance from children playing in the street a citizen of Baltimore was instantly electrocuted. A suit for damages was brought by the State of Maryland (to use of Dove) against the city of Baltimore and the Consolidated Gas, Electric Light & Power Company. The Court of Appeals of Maryland overruled the company's contention of contributory negligence as a matter of law—which had been accepted by the lower court and the case withdrawn from the jury—remanding the case for a new jury trial. (118 At. 753.)*

Abutting Owner Cannot Enjoin Construction of Duly Authorized and Properly Built High-Tension Line.—In Smith vs. Central Power Company an owner of abutting land sought to prevent the construction of a high-tension transmission line by the company in fulfillment of its contract to furnish the city of Bucyrus with electrical energy. The Supreme Court of Ohio held that although an owner of abutting property has certain rights peculiar to himself, such special rights do not include the right to prevent the construction in the streets of appliances which have been authorized by the city, and which do not interfere with his access, light, air or view, merely on the ground that they are a menace to life and property, unless such menace is peculiar to the particular abutting owner. High-voltage electric wires, the court averred, though a highly dangerous agency, are not a nuisance unless the manner of erection and maintenance is faulty and not in accordance with the usual custom, and the maintenance of such wire does not constitute the taking of private property without compensation. (137 N. E. 159.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Relations Between Companies Properly Considered in Ordering Extensions.—In People ex rel. Woodhaven Gaslight Company vs. Nixon the Supreme Court of New York, Appellate Division, held that where a company having a franchise to supply gas in certain territory manufactured no gas, but purchased all it distributed from another company which owned all of its stock, had advanced all the money invested, selected its officers from among its own employees, and arbitrarily divided their salaries and expenses, the Public Service Commission in ordering an extension of the gas mains could properly take into consideration the relation between such companies and was not necessarily limited to a consideration of the expense with relation to the capitalization or stated income of the franchise holder. (196 N. Y. S. 623.)

Different Rates for Contiguous Consumers of Same Class Discriminatory.—The right of the Dallas (Tex.) Power & Light Company to charge a higher rate for electrical energy furnished in Highland Park, a suburb of Dallas but a separately incorporated place, than is charged to users in Dallas has been denied by the Texas Court of Civil Appeals, which held that, although Dallas cannot fix the rates for Highland Park nor Highland Park delegate this power to Dallas, none the less any difference between rates charged two groups of consumers similarly classed is an unjust discrimination and that for consumers of like amounts of energy the same rate must apply, whether in Dallas or in Highland Park. This decision was given in the application of citizens of Highland Park for an injunction against the company, which had fixed a rate of 10½ cents a kilowatt-hour for Highland Park as against 6 cents a kilowatt-hour for Dallas.

Enforcement of Contract Not Interrupted on Claim that Bankruptcy of Utility Would Result.—The Central Power & Light Company won a suit against the town of Pocahontas, Ark., to enjoin contract rates restored by the town after the abolition of the Arkansas Corporation Commission, which had first granted and then set aside a higher rate. The commission had ordered the new rate continued for six months pending a rehearing which its abolition prevented. The trial court granted the suit and ordered an increase, fixing the amount. This judgment the Supreme Court of Arkansas reversed, holding that, in the absence of a statute, the enforcement of a contract between a city and a utility cannot be interrupted on the ground that it will force the utility into bankruptcy, the only remedy for such a condition being a modification of rates by mutual consent. (244 S. W. 712.)

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

F. C. Shenehon Joins Byllesby Organization

F. C. Shenehon, whose appointment as vice-president and general manager of construction and engineering for the

F. C. SHENEHON

Byllesby Engineering & Management Corporation, Chicago, was recently announced, is widely known as a hydraulic engineer. Mr. Shenehon obtained his engineering education at the University of Minnesota, where he received the degree of B.S. in 1885 and of C.E. in 1895. From 1886 to 1887 he was connected with railroad location and construction in Michigan and in 1888 he became engineer of water power and supplies at Sault Ste. Marie, Mich. In 1891 he became engineer of the ship locks and ship canals on St. Mary's River, Mich., where he stayed until 1902. From 1903 to 1905 he was engineer for the hydraulic investigations of the Niagara-St. Lawrence Rivers. In 1906 he became engineer of hydrography and hydraulics of the Great Lakes and outflow rivers. He then became the head of the College of Engineering at the University of Minnesota in 1909, where he remained until 1917. Since then he has been connected with various water-supply and flood-protection projects, notably at Natchez, Miss., in Minnehaha County, S. D., and on the Big Sioux River in the latter state. He investigated the water-power project of the Northern States Power Company in 1917 and has been constructing engineer for the Minneapolis Gas & Electric Company on the reconstruction of the Coon Rapids dam since 1920. His technical associations include the American Institute of Consulting Engineers and the American Society of Civil Engineers. He also is the past-president of the Detroit Engineering Society.

B. G. Lamme Receives Medal

Benjamin G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to whom was awarded the Joseph Sullivant medal, as announced in the Nov. 11 issue of the ELECTRICAL WORLD, was officially presented with the medal on Jan. 12 at the Ohio State University, his alma mater. The presentation was made in the presence of the trustees and faculties of the university, with appropriate ceremonies, in the chapel. President W. O. Thompson made the presentation address.

Engineers' Council Re-elects M. E. Cooley

Mortimer E. Cooley, dean of the engineering schools of the University of Michigan, was re-elected president of the American Engineering Council, executive organ of the Federated American Engineering Societies, according to an announcement made at the opening of the two days' meeting of the council in Washington last week. Dean Cooley is the second president of the council, his predecessor having been Herbert Hoover, who resigned soon after he entered President Harding's Cabinet. His re-election comes just as he is rounding out forty years at the University of Michigan, broken only by service in the Spanish-American War, during which he was chief engineer of the Yosemite. For many years Dean Cooley has been associated with engineering investigations and appraisals of utility properties, and he has been in charge of appraisal work at different times for the Wisconsin Railroad Commission and the Michigan commission.

John H. Trumbull, president of the Trumbull Electric Manufacturing Company, Plainville, Conn., has been made president pro tem. of the Connecticut State Senate for 1923.

Edward J. Nally, who took office as managing director of international relations of the Radio Corporation of America on Jan. 1, left New York on Saturday, Jan. 6, on the Steamship *Majestic* for Europe. Mr. Nally is going abroad to attend conferences at Paris, London, Berlin and other centers where plans to mobilize the interests of American, French, English, German and Italian radio companies will be discussed.

O. D. Street Becomes Vice-president of the McGraw-Hill Company

O. D. Street, well known for the past ten years as general manager of distribution of the Western Electric Company, has been elected vice-president of the McGraw-Hill Company, in executive charge of the ELECTRICAL WORLD, *Electrical Merchandising*, *Journal of Electricity and Western Industry*, *Industrial Engineer*, *Electric Railway Journal and Bus Transportation*. Mr. Street brings to these publications a broad background

O. D. STREET

of business training and a very extensive contact in the electrical industry.

Mr. Street entered the organization of the Western Electric Company in 1901 on his graduation from Williams and has a broad practical training. He was in charge of telephone sales on the Pacific Coast, assistant to the president, Atlanta branch manager, general telephone sales manager and latterly general manager of distribution. During the war he rendered invaluable service in reorganizing the warehousing division of the Quartermaster's Corps and establishing an orderly system of forwarding to Pershing's army where chaos had existed before. Under his administration the Western Electric system was expanded by the creation of twenty-two branch houses until Mr. Street was in executive charge of fifty jobbing houses distributing electrical supplies. This responsibility has entailed a personal contact with all sections of the country and all branches of the industry gained in the service of central stations, telephone systems, industrial plants and contractor-dealers, in cooperation with the manufacturers of practically all classes of electrical products. He has become a recognized authority on the broad problem of distribution, now one of the most pressing issues before the industries of America.

Mr. Street was born in Massachusetts in 1877. He is a resident of Bronxville, N. Y. He belongs to the Bankers', University, and Williams Clubs and the Siwaney and Pittsfield Country Clubs.

F. A. Ketcham General Manager Western Electric Supply Department

Frank A. Ketcham, who has been general sales manager of the Western Electric Company for the past four years, has been appointed general manager of the supply department, effective Jan. 15. Mr. Ketcham became associated with the Western Electric Company in 1900, starting at the Clinton Street office in Chicago. His early work was in connection with the telephone supply end of the business, and

F. A. KETCHAM

in 1905 he became telephone storekeeper. One promotion followed another until in April, 1911, he was made manager. Two months later he received the additional title of central district manager, with supervision over the Cincinnati, Omaha, Indianapolis and Minneapolis houses. Subsequently the Cleveland, Detroit and Milwaukee offices were opened under his jurisdiction. Mr. Ketcham was born in Saginaw, Mich., and was educated at the University of Michigan.

William J. Hagenah of the firm of Hagenah & Erickson, public utility engineers, Chicago, who, with a staff of engineers and accountants, has been engaged on public utility investigation work in South America, has returned to the United States. The work in question, which covered gas, tramway, telephone and electric light and power properties, extended over a period of one year and was undertaken for foreign banking interests.

W. B. Miser, manager of the Drumright division of the Oklahoma Gas & Electric Company for five years, resigned on Jan. 1. Mr. Miser has been recognized throughout the central part of the state as one of the civic leaders in Drumright and he has headed the most important organizations of the city. The Drumright division is to be consolidated with the Sapulpa and Bristow divisions. R. C. Coffy of Sapulpa will be the manager of the central division, and C. C. Stewart will be the local division manager at Drumright in connection with his work as commercial manager.

C. A. Miller, who has been chief electrical engineer of the Goodyear Tire & Rubber Company, Akron, Ohio, for over two years, resigned Dec. 1 to become electrical engineer in the engineering department of the Adirondack Power & Light Corporation, Schenectady, N. Y. Mr. Miller is a graduate of the University of Illinois in electrical engineering and was with Henry L. Doherty & Company for seven years and with the Goodyear Tire & Rubber Company for three years. During this time Mr. Miller has had charge of several large power house and substation developments as well as being assistant general superintendent of the Trumbull Public Service Company of Warren.

Kenneth A. McIntyre of the staff of the Society for Electrical Development started early in January on an extensive trip to about seventeen different cities throughout the United States and Canada. Mr. McIntyre's services will be available to local electrical leagues and clubs for meetings with the executives of governing committees, for the purpose of discussing the best methods of effectively carrying on local co-operative work through the interchange of experiences of the various leagues throughout the country. He will also address the industry where meetings are arranged, for the purpose of stimulating interest in local work.

Harry L. Garbutt has been appointed merchandising manager for the San Francisco office of the Westinghouse Electric & Manufacturing Company. He went to San Francisco in 1919 to become district supply manager for the Westinghouse company. Born at Port Huron, Mich., in 1879, Mr. Garbutt entered the electrical field at seventeen and for twelve years was engaged in overhead construction work in various Middle Western states. In 1908 he joined the organization of the Drew Electric & Manufacturing Company of Indianapolis, where he remained as sales manager until he became line-material specialist with the Westinghouse company late in 1909. In 1913 he became manager of the line-material section at East Pittsburgh and six years later supply manager for the San Francisco territory, a position he has since held.

H. F. T. Erben Vice-Chairman of Manufacturing Committee

H. F. T. Erben, whose appointment as vice-chairman of the manufacturing committee of the General Electric Company was recently announced, has been identified with that company since the early beginnings at Schenectady. In October, 1887, Mr. Erben entered the

H. F. T. ERBEN

employ of the Edison Machine Works. With the growth of the company and the later development of the plant at Schenectady, he became designing engineer of the direct-current department soon after the formation of the General Electric Company in 1892.

In 1914 Mr. Erben was made engineer of the Schenectady works, and in March, 1916, he was appointed assistant manager of the works, which position he held until his appointment as works manager in June, 1920. He held that position until his present appointment as vice-chairman of the manufacturing committee, which was effective Jan. 1, 1923.

Obituary

Wallace P. Hurley, who for the past twelve years has been a member of the sales organization of the Westinghouse Electric & Manufacturing Company, died at New Hope, Pa., on Nov. 28 of sleeping sickness. Mr. Hurley, who was a graduate of Purdue University, became associated with the Westinghouse company in 1910, when he joined the illuminating section of the supply department. In July, 1918, he was made manager of this section and one month later left the company to take a commission in the Signal Corps, U. S. Army. At the end of the war he returned and was assigned to the New York Sales office. Mr. Hurley was a member of the A. I. E. E. and of the I. E. S.

Alexander Kennedy, president and treasurer of the Pittsfield (Mass.) Electric Company, died at Pittsfield, Jan. 10, aged eighty-two years. Mr. Kennedy was born in Dumfriesshire, Scotland, and came to the United States in 1865. With three others he established the Pittsfield Electric Company in 1883 and became its head. He was a director of the Pittsfield Electric Street Railway Company until that system was merged with the Berkshire Street Railway and was the head of Pittsfield's first board of trade.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Patience Needed in Solving Our Problems

An Appeal Against Selfishness and for the Adjustment of Group Controversies as a Preliminary to United Action by Manufacturers, Jobbers and Merchants

BY H. P. ANDRAE
President, Julius Andrae & Sons Company

THE electrical jobber has been blamed for a good many things. Some of them are properly chargeable to the jobber and others are not. Out of the mass of discussion that has enveloped the electrical industry there seems to be coming, rather slowly but surely, a full recognition that the so-called jobber problem is broader than the jobbing field. It is one of many questions that are incident to the development of the electrical industry as a whole. The basis of its settlement will not be the welfare of the jobber to the exclusion of the rest of the industry. The basis will be the welfare of the whole industry and the best possible development of the service to the public. This is the real foundation on which the entire industry is built.

EACH ONE OF THE BRANCHES MUST JUSTIFY ITSELF

Broadly, industry may be divided into three parts. The first is the manufacturer, the second the distributing agency between the manufacturer and the retail merchant, and the last the retail merchant himself. Each must justify himself in the performance of a definite service rendered in a way that no other agency can equal.

With the manufacturer, in addition to his routine manufacturing problems, lies the duty of the development of better equipment as the needs of the field he serves may justify. With this is combined a certain class of educational and advertising work that reaches the public in a broad way, keeping the usefulness and service of the product well in the public eye and maintaining a demand for it. Back of his routine manufacturing and development problems lies the bigger duty of keeping the product up to a standard that makes it worth the price paid by the consumer.

The distributing agency, on the other hand, has the obligation of placing the product in the hands of the retailer at a cost and on a basis of service that can be provided in no other way. While this agency does not come into contact with the buying public directly, it has a definite responsibility in educational work in that it must see that the retail dealer is properly equipped to give service. This equipment cannot be insisted on and the dealer forced to equip himself, but it must be done through an indirect educational process. This is more difficult than a direct educational job would be. Distributing agencies, properly equipped and justifying themselves on a service basis, require an investment in plant, brains and energy that reaches enormous figures. The man who merely receives an order and passes it on to the manufacturer, taking his commission and having no further responsibility, will have a hard time to justify himself.

The retailer, coming into immediate contact with the consumer, not only has his merchandising problems to face but the duty of completing the educational and development work undertaken by the manufacturer and carried on by the distributing agency by bringing to the individual consumer the service that the others have developed. Backed by the manufacturer and distributing agency, he must see that the consumer actually gets value received for his money. Unless this chain of operation can be followed through successfully, an industry falls partly or wholly short of justifying itself, because it fails to render the service paid for.

NOTHING IS GAINED BY HEATED CONTROVERSY

Nothing can be gained in the long run by the manufacturer, the distributor and the dealer getting on opposite sides of the fence and throwing "rocks" at each other. Each group has individual problems that are of little or no direct interest to the others. Each group has problems that are common to all. The quickest and surest way to the solution is agreement among the individuals of each group on the problems affecting that group only. This means getting together on the basis of the greatest good to the group and not for the advantage of some particular faction that may be powerful for the moment. So long as there are individuals who will seek to turn every move to immediate personal advantage there will be strife and discord in the group and it will be impossible for that group to meet the others and discuss the common problems of the industry. In short, the manufacturers, jobbers and retailers must settle their own individual problems on a broad give-and-take basis before it will be possible for them to make much progress when they meet as an industry to develop co-operatively the service that the public must have.

An Electrical Manufacturer Raises This Question—

"WHY should a manufacturer whose factory is located, say, in Syracuse carry branch stocks in New York and Boston when there are in the two cities anywhere from two to three hundred jobbing houses selling the class of goods which this manufacturer produces? The principal effect is to keep in business so-called jobbing houses which have not the financial resources to carry the volume of material which it would be necessary for them to have in order to do business if they drew their supplies from the manufacturer's factory stock. Manufacturers' branch stocks thus tend to multiply the number of jobbing houses, of which, as every one knows, there are too many. Is it good for the industry?"

Concretely, much of the controversy in the electrical industry is based on suspicion of motives, trade rivalries and the fears of individuals that they are not getting their just due. These sources of discord must be cleared away before much progress can be made in putting the industry as a whole on the basis of full health. We must cease to view our problems as manufacturers', jobbers' or dealers' problems, to be solved for the selfish advantage of one or the other group, and view them as broad problems of the industry, to be solved for the best interests of the greatest number and for the betterment of service. This may sound altruistic, but as a matter of sober fact it is the one sure method of preventing throat-cutting competition, and also what is still worse, the adoption of policies that mean certain monetary loss, where some one fears that some one else will get an advantage or is going to do something that will create resentment.

A "devil-take-the-hindmost" policy has never failed to wreck those concerned in it. Much of the confusion in the electrical industry right now is traceable to the newness of its development and to temporary causes incident to financial depressions. The biggest influence for clearing up the situation will be clear thinking from an industry and public service viewpoint and above all patience in plugging away at the problem. There is no such thing as a quick settlement. The condition will only be changed by a concerted effort to put the industry as a whole solidly on the next step upward in the progress of development.

Who Is to Guide the Non-Electric Store

How This Growing Influence May Be Molded Into Our Scheme of Distribution as a Constructive Help to Electrical Dealers —The Jobbers' Responsibility

BY A MANUFACTURER

IT WOULD be well, it seems to me, if the manufacturers and jobbers of electrical appliances, devices and materials that go into the homes of the people would give more careful thought and planning to directing and controlling the growing distribution of electrical merchandise through non-electric stores. Electrical construction will naturally remain permanently in the hands of men of the electrical industry, and the sale of electrical appliances and accessories will also continue to be an important and growing feature of the business of the central-station company, contractor and dealer. But we know from our own personal observation that a constantly increasing amount of these commodities is going to be sold by men outside of our industry, for the simple reason that the general merchant is an enterprising trader, very much alive to the wants and needs of the people to whom he sells. And as the ordinary householder becomes more and more interested in these goods and buys more of them, he will find more and more electrical merchandise offered to him in the stores which he habitually frequents in search of other miscellaneous household supplies.

The company with which I am connected and the majority of other electrical manufacturers have restricted their distribution largely within the electrical industry. Many manufacturers of domestic appliances who were already established in the hardware, drug and department-store field electrified their lines when electric cooking devices became popular and began to sell percolators and other utensils, until today the hardware and department stores are selling electrical appliances in wide variety and in considerable volume. Accessories such as shades, plugs, fuses and other devices which can be attached to or plugged into approved wiring, however, have continued to be looked upon more as a distinctly electrical line and to be sold mainly through the electrical trade. But even here non-electric distribution is beginning to edge in. Inquiries are continually received from large mail-order houses, chain-store groups or other large distributors in the general merchandise field, large orders are flashed at manufacturers, and many of them sell. Whether we like it or not, therefore, the non-electric store is becoming a growing factor in the marketing of these goods.

It is clearly time, therefore, for electrical men to realize that their goods are fast progressing toward the staple stage, when the public demand will attract all classes of merchants to the sale of this household electrical merchandise. We must, besides, recognize the fact that, after all, the service of the public is the prime consideration, and if it will facilitate the sale and use of electrical appliances and accessories to have them on display in stores other than those of purely electrical dealers, it is to the interest of us all to have it so. For even the electrical dealer himself will benefit, because the more pressure is put behind the sale of these goods, the faster the market will develop and the better the business will be. Consequently, the problem is not how to prevent or retard this growing sale through non-electric stores, but rather how to guide it and develop it along the most constructive lines.

THE JOBBER'S RESPONSIBILITY

The opportunity lies in the direction of the electrical jobber, for if he will function as distributor for the non-electric store as well as for the man whom we now call the regular electrical dealer, he will gradually knit the general merchant who sells electrical merchandise into the organized electrical distribution system. He will guide him through the dangers of his inexperience and make surer his prosperity. He will protect the existing electrical dealer against careless or ill-advised competition, with the result that he will profit by this greater pressure of market building and not be hurt by a struggle for the existing business. He will assure a better, fuller merchandising service to the public, which will be for the advancement of all electrical interests. And the jobber can do this by calling on these non-electric merchants who do or could profitably sell the electric line, by interesting them more deeply in the principle and purpose of the electrical industry, by influencing them to feature and support devices that the electrical industry is pushing, and by ultimately lining up the man behind the electrical department in the non-electric store to feel himself not a free-lance outsider but a member of the local electrical community concerned in co-operating in all its constructive plans for market development.

All this the electrical jobber can do to his own good profit, and the manufacturer can assist him greatly by practical co-operation in selling plans. It would surely be to the advantage of the rest of the industry.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Insulating Material Business Is Strengthened by Automotives

Increased production in the automotive industry and heavier buying by radio manufacturers are the major influencing factors in the present active insulating material market. A leading company in the Eastern territory states that his sales for the last six months of 1922 show an increase of over 60 per cent in comparison with the first six months of 1922.

Deliveries for insulating material are for normal periods. There have been no recent price changes, although there is a possibility of a price increase if the present upward trend of prices on raw materials continues. The sales outlook for the next six months is considered good, although one important manufacturer expects a falling off in business for this year as compared with 1922.

Collections in Atlanta Show Improvement

Taken as a whole, collections have shown some improvement during the past thirty days. Jobbers report municipalities and the larger central stations as paying promptly, with an improvement to be noted in the length of time taken by industrials to liquidate accounts. Payment of accounts by the small contractors, however, continue slow, and it requires continuous efforts to obtain moneys due.

Trade acceptances are being dealt in to a small extent, but there is a disinclination on the part of purchasers to use this form of credit. No likelihood of a tightening up of credit in the next thirty days is expected, and one of the larger houses expresses the opinion that collections will continue to improve for the rest of the year. Increases in the value of agricultural products should enable small-town merchants and industrial companies to improve their financial conditions materially, and the outlook is bright for a continued improvement.

Purchases for Spring Delivery Are Heavy in Cleveland

Electrical business in Cleveland is quite active in all lines, according to the January *Monthly Business Review* of the Federal Reserve Bank of Cleveland.

"The extensive building program which has been put through this fall has brought additional loads on the power plants," says this periodical, "and is partially responsible for the strength of business in that particular field, although the development in many industrial fields is also requiring additional electric power and equipment. There is an unusually heavy demand for bare and insulated electrical wires and lead-covered cables. A large concern reports that orders booked during recent months in the aggregate are about double those for the corresponding months of last year. The placing of so much business at this time of year is looked upon by manufacturers as rather unusual and is attributed to the fact that copper has shown a rising tendency. It is also true that purchases for spring delivery are heavier than for some years past, and this is looked upon in the trade as an evidence that public service corporations are contemplating considerable extension."

Crude Platinum Prices Drop

Prices of crude platinum dropped from $2 to $3 an ounce within the last week. Crude platinum can be obtained from $109 to $112 an ounce, while refined platinum is nominally quoted at $118. The sudden appearance of 800 ounces of sweepings and reclaimed metal, together with the failure of consuming demand to reach the point refiners expected, brought about lower prices. Imports during the last week were four boxes of about 80 ounces each from South American countries.

Smelter Production of Copper 475,000,000 Lb. Heavier

Smelter production of copper in 1922, according to the United States Geological Survey, covering actual production for eleven months and estimated production in December, was about 981,000,000 lb., an increase of 475,000,000 lb. over 1921. Production was resumed by practically all large mining companies except the United Verde Copper Company by or during April, 1922, one year from the general shutdown. Smelter production of copper for December, as estimated by the companies, was 103,300,000 lb., or at the rate of about 1,240,000,000 lb. a year.

Total production of new refined copper from domestic sources was about 897,000,000 lb., 288,000,000 lb. more than in 1921. Refinery output of new copper obtained from domestic and foreign sources, including imports of refined copper, was about 1,398,000,000 lb. In addition to output of new refined copper, about 112,000,000 lb. of secondary copper was produced at refineries, making total refinery output 1,510,000,000 lb.

Up to Sept. 21 total imports of copper in ore, concentrates, matte, blister and refined copper were 363,443,226 lb., of which 75,556,317 lb. were refined copper and 192,050,397 lb. blister. Exports for the first ten months were 634,501,851 lb.

Survey Shows Substantial Rise in Wages of All Labor

A nation-wide survey of wage changes covering four hundred thousand wage earners in twenty-three industries just completed by the National Industrial Conference Board shows a substantial rise in hourly and weekly earnings in all classes of labor from July, 1922, to October, 1922. In only two industries, lumber and rubber, was there a decrease in hourly wages during this period. In automobile manufacturing and book and job printing a slight decline took place in weekly earnings.

The average hourly earnings of all wage earners covered in this investigation were $0.238 in July, 1914. In July, 1922, they had risen to $0.484, in August to $0.486, in September to $0.495. In September, 1922, therefore, the average hourly earnings of all the wage earners covered were 108 per cent higher than in July, 1914.

The average weekly earnings of all wage earners, which were $12.27 in July, 1914, had risen to $23.09 in July, 1922, to $23.31 in August and to $23.88 in September. In the latter month they were 95 per cent above the July, 1914, level. The average weekly earnings of unskilled labor appear to have increased more since 1914 and during July, August and September of 1922 than those of skilled labor. Average weekly earnings of unskilled labor in July, 1922, were 87 per cent above 1914 and in September, 1922, 95 per cent above pre-war levels, while those of skilled labor in July, 1922, were 86 per cent above 1914 and in September, 1922, had risen to 92 per cent above the July, 1914, level.

The actual hours worked per week per wage earner also increased from 47.7 in July to 48.2 in September, although this figure is still below that

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0296	$0.0295	$0.0258
Cold finished shafting, per l	0.0378	0.0375	0.0337
Brass rods, per lb.	0.1742	0.171	0.1516
Solder (half and half), per lb.	0.2425	0.24	0.2058
Cotton waste, per lb.	0.1175	0.11	0.10
Washers, cast iron (¼-in.), per 100 lb.	4.33	4.33	4.50
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	3.11	3.20
Machine oil, per gal.	0.36	0.36	0.40
Belting, leather, medium, off list	49%	37%	44%
Machine bolts, up to 1-in. x 30-in., off list	51½%	52%	58%

for July, 1914. Plant hours and the nominal working week also improved steadily during July, August and September of this year, though these also were still considerably below the prewar levels.

December Was Best Month for Chicago Motor Sales

The Chicago motor sales rate maintained during October and November kept advancing steadily upward during December, with the result that five manufacturers report December their best month of the year. Although the year's motor activity did not start to come back until July, the latter half of the year overcame some of the sluggishness of the first six months. Relative comparative figures of the year's business at present are not available in most cases, but one company reports a 20 per cent increase for 1922 over 1921. The other companies declare that their total business is above their 1921 figures. The greatest demand has been for sizes ranging from 1 hp. to 20 hp. Prices are firm and deliveries are slowing up, with a three-month to four-month period for promised shipments. Stocks are in good shape with few exceptions where an accentuated demand has depleted that one size. With the increase in price of the raw materials, cotton, rubber and copper, there is a feeling that the price tendency will be upward.

Declares Recent Demand for Cleaners Was Phenomenal

"Demand for electrical household cleaners during the last few months of 1922 was phenomenal, to judge by the experience of the P. A. Geier Company." Such was the recent statement of General Manager Frank J. Gottron of this Cleveland concern. He declared that on Dec. 30 his factory, after a month of working a night shift as well as going at full daytime capacity, had on hand only 600 Royal cleaners, 8 per cent of the regular factory minimum.

"December business showed a 25 per cent increase over normal," said Mr. Gottron, "and orders for January shipment are far above the usual volume, which proves that the trade is sold out. Chicago dealers were so hard pressed for machines in the last days before Christmas that one factory representative there, in trying to help a certain dealer fill his orders, could locate only thirty cleaners although he telephoned forty stores.

"The company never before experienced such heavy Christmas buying, even in the war-boom days, and orders were still pouring in after the holiday at such a rate that production was not halted during the yearly inventory taking but was continued at a fair rate of speed."

Chinese Electrical Imports Show Heavy Gain

In his report to the Department of Overseas Trade on the commercial and economic situation in China, H. H. Fox, commercial counselor to the British Legation at Peking, says of electric light and power that the customs report for 1921 shows that the importation of electrical materials and fittings rose from 6,300,000 taels in 1920 to 13,200,000 in 1921. Adverse trade conditions caused a marked decline in the sale of small lighting plants, which is partly ascribed to the installation of new or improvement of existing plants for public light services. Many contracts for large power and light plants for cities in the interior were settled, and there is an increasing tendency to install larger units of 1,000, 2,000 and 5,000 kw., while only a couple of years ago 200 kw. and 400 kw. were considered sufficient to meet requirements. These installations are bound to have an effect on China's industrial progress. It is interesting to note that a Chino-German company purchased during the past year a large quantity of land near Soochow for the manufacture of motors and electrical appliances, this being the first project of this nature to be mooted in China.

Instrument Market Brightened by Growing Interest in Accurate Control

Electrical instruments generally are in good demand, according to manufacturers' representatives, although nothing spectacular marks the current trade. Well-known lines are enjoying a continuing run of orders, the business embracing a great variety of applications. Interest in the relations between power-factor and rates in industrial circles is slowly bearing fruit in the use of more and more curve-drawing apparatus, and the attempt to gain more accurate control of electric heating process work is also a factor in the instrument market.

Radio fans are buying instruments much more freely than formerly, even for lower-priced tube sets, and the demand of automobilists for attractive dashboard equipment is growing. Although many instruments are of long-standardized varieties, there does not seem to be any marked tendency to stock heavily on the part of either agents or jobbers. By maintaining close touch with the factories current needs are being comfortably met, and the outlook for the year's business is excellent.

For additional information regarding present conditions in the instrument market in fifteen important centers of the country turn to "Week in Trade" on page 191.

Anaconda Acquires Chile Copper

The Anaconda Copper Company has acquired control of Chile Copper through purchase of the holdings of the Guggenheim family. This gives Anaconda the source of cheap copper necessary to make it the great manufacturing-producing company in copper that United States Steel is in iron and steel.

This will give Anaconda the leadership in copper that Amalgamated, its precursor, held prior to the advent of the "disseminated coppers," and rounds out the plan conceived when Anaconda acquired American Brass. Tying a current low-cost producer to Anaconda gives the enterprise a financial stability that will probably never be lost.

Anaconda, according to officials, must still develop Andes as well as the zinc-producing ground of the Butte camp acquired last summer by purchase of the Anselmo and other ground. However, from now on its problem will be to round out the manufacturing end with zinc-oxide works, acid-phosphate plants, a brass foundry and fine-wire mill at Great Falls, thus developing a market for its large bodies of phosphate in Idaho and Montana and the sulphuric acid that it can make at Anaconda, as well as utilizing to the utmost the geographic advantage of having copper, zinc and cheap power available in the center of the West, whence Pacific Coast and trans-Mississippi enterprises can be advantageously supplied with copper wire and brass. Acquisition means no change in Anaconda's program for developing its South American Andes property. Anaconda will purchase copper from the Chile company at the market price, and the return on its investment will be in dividends from Chile profits.

The Metal Market

Producers continue to quote 14.75 cents, delivered, for prompt copper and for deliveries extending over the next two or three months.

Sales have not been so large as they averaged toward the close of 1922, but neither have producers as much copper available. Some have been forced to decline offers at the ruling price. However, there is no scarcity of the metal, for others are able to supply up to 1,000-ton or 2,000-ton lots for any delivery from spot on. Only one producer or consumer reports any tendency to shade the 14.75-cent price where the freight rate is anywhere near normal, and this report was only a rumor.

NEW YORK METAL MARKET PRICES

	Jan. 10, 1923 Cents per Pound	Jan. 17, 1923 Cents per Pound
Copper		
Electrolytic	14.75	14.75
Lead, Am. S. & R. price	7.25	7.40
Antimony	6.35	6.35
Nickel, ingot	36.00	36.00
Zinc, spot	7.05	7.00
Tin Straits	38.87½	38.87½
Aluminum, 98 to 99 per cent	23.00	23.00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in electrical supplies is somewhat slower than last week, a short lull following the heavy buying experienced during the last few weeks of the old year and inventory taking by the jobbers and dealers. Wholesome conditions prevail, and manufacturers expect a large amount of the season's heavy orders to be signed within the next two or three weeks. Construction of residences and commercial buildings continues at a fair rate. Increased production is reported in the iron and steel and textile industries. Orders from the central-station companies are in greater volume.

New York.—A stiffening in prices for wire, conduit, armored cable and loom is noted, following a slightly increased demand from the building industry. Prices of some makes of fixtures are lower. Competition in the vacuum cleaner has forced some reductions. Central-station business is somewhat improved. Some manufacturers report raw material shortages and transportation difficulties. Stocks generally are normal.

Boston.—The demand for electrical supplies has slightly subsided during the past week, and jobbers are making the most of the opportunity to close gaps in stock. Railroad difficulties are hampering deliveries and heavy snows and rains have retarded highway travel. Building operations in New England continue at good volume and general manufacturing shows improvement. Manufacturers of electrical machinery are seeking more skilled labor. Prices are stiffening in loom, lead-covered cable and non-indicating fuses. Quotations on fixtures are weaker in some cases owing to large stocks. Deliveries on some types of meters are now running on a four to six weeks' basis. Central stations have suffered little from storms thus far. Telephone facilities are far behind installations, and the demand for new electric lighting service is outrunning the immediate satisfaction of many applications.

Chicago.—Jobbers report that the start of this year's business exceeded that of 1922. Approximate estimates on the volume of increased business obtained during the year are found to vary between 20 and 30 per cent over 1921. With an increasing price trend on wire, the demand has risen. The conduit supply is still low, requiring close attention to shipments and prices. Pole dealers report a steady demand, but the freight situation is such that deliveries are uncertain. During the week one high-tension manufacturer sold three 33,000-volt substations rated at 450, 600 and 900 kva. to a Middle Western Utility. Foreign purchases have been active for the 110,000-volt air-break switching equipment. Another firm received orders for 2,300-volt indoor switching equipment for a California utility. Fuses rated at 70,000 volts are the main volume of another concern.

The demand for flatirons, according to most jobbers, is featureless. Prices remain unchanged. The call for rectifiers for storage batteries is fairly steady, being stimulated by the radio demand for charging the "A" battery. Only the largest jobbers carry this equipment, but stocks are low at the present time. Dealers declare that while their sales rate on electrical instruments for the past three months has been good, the month of January is starting with the same maintained rate.

Atlanta.—General conditions in the Southeast are the best for some time, and electrical jobbers and dealers are most optimistic over the prospects for the year. While prices have been reduced in a few items, the general trend is upward. Now that inventory is over orders will begin to be placed to bring stocks up to normal, and this, together with the sales campaigns that are being launched, will see the movement in all lines stimulated. One of the largest central-station companies in this section has announced an improvement and expansion program for 1923 which will call for the expenditure of $6,500,000 and other central stations are planning similar programs. Building material prices have advanced somewhat, but this is having little effect on building in Atlanta, and this year will doubtless be the biggest in its history. Cotton has reached the new high of 27.39 cents, which is having a stimulating effect throughout the territory. The increasing interest of Eastern industries in the establishment of mills in the South indicates that building materials and electrical equipment lines will receive a considerable boost before the year is over.

Christmas witnessed an unusually good volume of sales in flatirons, and the general outlook for 1923 is very bright. One of the largest jobbers is beginning a sales campaign, and increased sales are anticipated, with adequate stocks on hand to meet the demands. Prices are firm and no changes are expected for some time. Jobbers report good sales of rectifiers, particularly those jobbers concentrating on sales of radio equipment. Jobbers report a slow movement in the electrical instrument line and anticipate little interest to be displayed.

St. Louis.—A steady and strong demand for flatirons has existed since last summer, and as a result of a conservative policy in carrying stocks on the part of both jobbers and dealers turnovers have been good and profits very satisfactory. The increased trade before holidays reduced stocks materially below normal, but normal stocks again obtain. While competition continues keen, prices are fairly well stabilized. The increased use of radio tubes requiring storage batteries has greatly stimulated the sale of small low-priced rectifiers. There is some demand for larger machines for electric automobile charging and for moving-picture machines, but neither of these fields may be classed as active. On the whole, stocks are in suitable condition. There is a tendency on the part of industrial plants to consider portable instruments as somewhat of a luxury, and sales during the recent period of business quietude have been dull. Some improvement is found now, due to occasional purchases for the purpose of checking power consumption and factory efficiency. Recording-chart instruments are increasingly popular for this purpose. Switchboard instruments are experiencing fairly good sales because of expansion on the part of central stations and the smaller municipal plants. Slightly better sales are found in the coal districts since the strike settlement.

Cleveland.—The week's business has been slow. Firm prices prevail and demand generally is steady. Conservatism has been the predominant note. The most spectacular feature was an active movement in small motors. Poles and high-tension equipment orders were somewhat lower this week, new construction having been retarded by unfavorable weather conditions. The same weather conditions were advantageous to heater sales, however, jobbers reporting their movement as brisk. Demand for conduit continues to prevent overstocks, while the supply of wire is improved.

New Orleans.—Because of the demand of radio users, business in rectifiers has increased conspicuously during the last month or six weeks. Business in electrical instruments is slow. There is never much demand, except sporadically, when some institution or school lays in a large supply. The flatiron business is sluggish.

St. Paul-Minneapolis.—The market for flatirons is slowing up slightly after the holidays, but the steady undercurrent of demand for this staple article is not materially affected. Dealers report a flood of "bargain" irons and a good deal of price cutting by department stores, mostly on inferior goods. The inclination here is toward a decline in prices. Many dealers are cutting slightly to offset the department-store raid. Small-size rectifiers are keeping pace with the radio sales, being in good demand, while the larger sizes are sluggish. The supply of both, particularly the small sizes, is low. Instruments are steady here, but since central-station work and any other switchboard work is slow, it doesn't seem reasonable that instruments could be anything else.

Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Cooking Appliances and Signal Apparatus

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Flatirons	Rectifiers	Instruments
New York																		
Demand	Act.	Sdy.	Sdy.	Slow	Slow	Slow	Slow	Slow	Sdy.	Spy.	Sdy.	Sdy.	Act	Sdy.	Sdy.	Slow	Sdy.	Sdy.
Supply	Nml.	Hi.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low	Low	Nml.
Price trend	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Firm	Firm	Firm	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm
Chicago																		
Demand	Act.	Sdy.	Act.	Sdy	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Low	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Boston																		
Demand	Act.	Sdy.	Act.	Slow	Slow	Slow	Slow	Slow	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Act.
Supply	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Low
Price trend	Firm	Inc.	Inc.	Firm	Firm	Firm	Dec.	Firm	Inc.	Firm	Frm.	Firm	Firm	Dec.	Firm	Firm	Firm	Firm
Atlanta																		
Demand	Act.	Slow	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Slow	Act.	Act.	Act.	Act.	Slow	Act.	Act.	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																		
Demand	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Nml.	Firm	Inc.	Inc.	Firm	Firm	Dec.	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																		
Demand	Act.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Inc.	Firm	Firm	Dec.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																		
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Slow	Slow	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Slow	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																		
Demand	Slow	Sdy.	Slow	Act.	Act.	Act.	Slow	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Slow
Supply	Low	Nml.	Low	Low	Low	Low	Nml.	Low	Nml.	Nml.	Hi.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm
St. Paul-Minneapolis																		
Demand	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Act.	Slow	Slow	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Low	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Hi.	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm
Denver																		
Demand	Act.	Act.	Act.	Slow	Slow	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Slow
Supply	Nml.	Nml.	Low	Low	Nml.	Low	Low	Low	Hi.	Nml.	Low	Nml.	Hi.	Hi.	Nml.	Nml.	Low	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Inc	Inc.	Firm	Firm	Firm	Firm	Nml.	Firm
Portland-Seattle																		
Demand	Sdy.	Slow	Act.	Act.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm

San Francisco.—Jobbers' annual inventories disclose far larger stocks than in 1922, but the vastly increased construction business with its larger individual orders and greater rate of turnover demands such increased stocks, and they are not viewed with any apprehension. Collections have steadily lengthened throughout the past year until they now average just beyond sixty days. Credit managers feel that this rate must be improved and are ready to take measures for vigorous handling. All customers are required to better their own collections, to scrutinize carefully their own credit risks and generally to put their own financial houses in order. The number of failures and of seriously overdue accounts has more than doubled since last year and will run to a higher proportion of sales volume, even considering the 1922 increase in business. New accounts are very cautiously handled and personally followed until they have been proved satisfactory. Prices on such wiring staples as rubber-covered wire, tape and lamp cord have increased about 10 per cent.

Denver.—January business continues satisfactory. Local supply of electrical material and equipment is seriously curtailed by a one-hundred-thousand-dollar fire in a large warehouse. Fortunately the annual inventory had reduced stocks to a minimum. Manufacturers with warehouse stock and other jobbers are co-operating with the company suffering the loss in filling orders and caring for business until emergency stock can be obtained. Lack of winter weather has allowed continuance of the building program. Local permits exceed those of last month for same period. Credits have been tightened owing to slow collections. In the house-wiring business contractors in severe competition are allowing work obtained on unreasonably low bids to remain unsettled.

Portland-Seattle.—Electrical jobbers report reasonably good business for this time of year. Sales are less than before the holidays but better than a year ago. Dealers are experiencing a very marked decrease in sales, as are contractors on certain classes of work. A number of large industrial installations are under construction at present, and the prospects are very good for the coming season. Farm plants are not moving rapidly, but inquiries are becoming active again. An advance of 5 per cent in the price of washing machines is reported and copper wire also has advanced about 5 per cent since the first of the year. Construction for 1922 was the greatest in the history of the Northwest.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Bosch Business Increasing

The American Bosch Magneto Corporation's production is running 70 per cent ahead of a year ago and is approaching normal, according to President Arthur T. Murray, who reports an operating force of 1,600 at the opening of the year. Prospects for 1923 he regards as excellent. A production of $10,000,000 to $12,000,000 is forecast at the main factory in Springfield, and $5,000,000 to $6,000,000 at the Gray & Davis plant in Cambridge.

G. E. Conference at Pittsfield

Members of the newly organized merchandising department of the General Electric Company had a three days' conference in Pittsfield, Mass., recently, at which electric fans formed the chief topic of discussion. Experts on the manufacture and merchandising of fans were present from all parts of the country. J. O. Weathersby was toastmaster at a banquet which concluded the sessions, and R. H. Heaney, head of the merchandising department, and C. C. Chesney, manager of the Pittsfield works, were among the speakers.

Chicago Branch Improves Store

The Manhattan Electrical Supply Company, 112-114 South Wells Street, Chicago, has changed and regrouped its internal store departmental locations with a view of improving the handling of local business. The offices formerly on the first and fourth floors were placed on the second floor, which gave the first floor more room for merchandise display. The entire first floor has also been redecorated and refinished, with the addition of new showcases and lighting fixtures.

For improving the firm's distribution in the Middle West the following salesmen were added the first of the year: Carl Mack, Oshkosh, Wis.; Charles Stegmaier, Cleveland, Ohio; Vincent Lonergon, Milwaukee, Wis.; Joe Hughes, Kokomo, Ind., and Robert Burns, Indianapolis.

Northern Engineering Works Changes in Addresses

The Northern Engineering Works, electric crane and hoist builders of Detroit, announce changes in addresses of their local sales offices as follows: New York City, 30 Church Street, room 623, in charge of H. C. Rood; Philadelphia, 51 Estey Building, in charge of John H. Bricker; Chicago, 53 West Jackson Boulevard, room 630 Monadnock Building, in charge of M. H. Haeger of the Abell-Howe Company, and St. Louis, 606 Pontiac Building, in charge of J. S. Davidson.

Birtman Electric Holds Sales Conference

A ten-day executive sales conference was held at the Edgewater Beach Hotel, Chicago, starting Jan. 2, by the Birtman Electric Company, 640 West Lake Street, Chicago. The purpose of this conference with the ten newly appointed divisional sales managers was to work over and adopt plans for the distribution of the "Magnetic house cleaner," a product of eighteen years of development.

Ten divisional offices will serve as headquarters for 110 branch offices, whence will radiate 3,000 sales engineers. Of these 110 district managers thirty have already been appointed. The ten divisional sales managers are as follows: Boston, F. J. Caldwell; New York, J. K. Tyner; Washington, C. H. Magee; Detroit, B. K. Sheldon; Chicago, W. R. Noxon; Minneapolis, V. V. Corbin; Seattle, Ralph Wilder; San Francisco, H. G. Gute; Dallas, F. C. Roeggl; Kansas City, E. V. Swanstron.

The organization has for fifteen years been engaged in manufacturing housecleaning devices, fractional-horsepower motors and electrotherapeutical equipment. The manufacturing floor space of 55,000 sq. ft. will make possible the production of a thousand cleaners a day. The conference terminated by a banquet at the University Club on Jan. 11.

Gibb Instrument Company Is to Make and Sell Pabst Products

The Gibb Instrument Company, Bay City, Mich., has taken over, under exclusive license, the manufacture and sale of the automatic and semi-automatic electric arc-welding machines developed and heretofore manufactured by the Fred Pabst Company, Milwaukee, under its various letters patent, and has contracted to act as selling agent for the Pabst line of patented covered electrodes. The Fred Pabst Company has spent more than two years in the development of this line of equipment, and the field of application is said to be very wide, embracing the welding of tanks, range boilers, bells, drums and tubing. The Gibb Instrument Company has announced its intention to encompass the entire range of electric welding equipment, and this contract marks a long step in that direction.

Westinghouse Secures Extensive New Sales Field

The Westinghouse Electric and Manufacturing Company has concluded an agreement with the Metropolitan-Vickers Electric Company, Ltd., which provides the opening of much foreign territory for independent trade for the Westinghouse company, which can now enter New Zealand, Australia, South Africa and India to book new business directly.

Under the old agreement of 1919, superseded by the present agreement, Westinghouse could not book business in the above territories as the field was opened only to Metropolitan-Vickers, who manufactured all their capacity permitted, turning the overflow over to Westinghouse.

Westinghouse has outlined an extensive selling campaign for the territory newly opened, and some of the best salesmen are now on their way to enter negotiations for available business. Additional men will be sent in a few days.

The significance of the new agreement is that Westinghouse, through its extensive sales organization, will be able to compete more successfully for new business in this territory and at the same time will receive the full manufacturer's profit on all orders booked.

Kerite Increases Capital

The Kerite Insulated Wire & Cable Company, Seymour, Conn., has filed a certificate with the Secretary of State adding $812,000 to its capital stock. The addition calls for 8,120 shares of "B" stock.

Piedmont Plans New Building

The Piedmont Electric Company, Asheville, N. C., is having plans made for the erection of a five story building, 44 ft. x 100 ft., for its own use. It will cost about $50,000 and will be designed to house one of the most complete electrical establishments in the South. The firm has been in operation in Asheville since 1902 and has had a branch in Greensboro three years.

Louis Allis Sales Conference

The Louis Allis Company of Milwaukee, manufacturer of motors, held a general conference of its sales staff at the plant in Milwaukee, Dec. 11 to 14, at which were present the sales engineers and distributors from all the territories in the United States and Canada.

In addition to the discussion of general sales problems, special analysis and study was made of a number of interesting new motor applications which the company has recently been making, and the meeting was addressed by various representatives of manufacturers of control apparatus. The conference concluded with a dinner to the entire staff.

Ohio Electric and Controller Appoints Alabama Agent

The Ohio Electric and Controller Company, 5900 Maurice Avenue, Cleveland, announces the appointment of the Southern Industrial Engineering Company, Inc., American Trust Building, Birmingham, Ala., as its agent for the sale of "Ohio" magnets in Alabama.

This company also announces the opening of an office in St. Louis. Thomas E. Beasley will be district sales manager in charge of the motor and magnet sales in the St. Louis district.

New Jobbing Firm Opens in Appleton, Wis.

A new corporation to be called the Langstadt Electrical Company has opened temporary quarters in Appleton, Wis. Organizers of the new company are A. C. Langstadt, E. A. Killoren and A. A. Schneider. Application will be made to the Railroad Commission for permission to incorporate for $100,000, with the three men as part owners. The concern will do a general electrical business, including contracting, jobbing and retailing.

Mr. Langstadt formerly was president of the Langstadt-Meyer Company and one of the founders of that firm thirty years ago. He disposed of his interest recently to August Meyer and will become head of the new company and its general manager. Mr. Killoren formerly was salesman for Lanstadt-Meyer Company, and will be sales manager for the new company. Mr. Schneider, who served the Langstadt-Meyer firm as foreman of construction for twenty-three years, will act in a like capacity for the new firm.

General Electric Orders Increase 50 per Cent

Orders received by the General Electric Company for the three months ended Dec. 31, 1922, totaled $66,568,333, an increase of 50 per cent over the corresponding three months of 1921. New business booked in twelve months of 1922 totaled $242,739,527 as compared with $179,721,680 for 1921, an increase of 35 per cent.

The Flexlume Sign Company, 74 Kail Street, Buffalo, manufacturer of metal electric signs, etc., is planning the erection of a new factory at Military Road and Skillen Street, to cost $45,000.

The Acheson Graphite Company, Buffalo Avenue, Niagara Falls, New York, manufacturer of electrodes, electrical products, etc., plans the erection of a new one-story addition.

The C. J. Litscher Electric Company, 41 Market Avenue, Grand Rapids, Mich., manufacturer of electrical products, has arranged plans for rebuilding its three-story factory recently destroyed by fire. The new structure is estimated to cost $150,000, with machinery.

Western Electric Company Announces Important Sales Appointments

The Western Electric Company announces important organization changes, which were effective Jan. 15, as follows:

F. A. Ketcham has been appointed general manager of the supply department. For the past four years Mr. Ketcham has been general sales manager.

G. E. Cullinan assumes the position of general sales manager. Mr. Cullinan entered the employ of the company upon his graduation from Williams College in 1901 and for several years was connected with the New York house. He went to St. Louis in 1907 and was manager there from 1909 to 1918, when he went to Chicago as central district manager.

L. M. Dunn, who for the past three years has been manager of the Eastern district, which includes the New York and the New England territory, has been appointed general merchandise manager of the general manager's staff.

W. J. Drury has been made manager of the Eastern district to fill the vacancy created by Mr. Dunn. Mr. Drury has been sales manager of the New York house for the past three years and is succeeded in that capacity by J. F. Davis, who has been sales manager of the Boston branch for the same period.

T. E. Burger has been made sales manager at Boston. Mr. Burger was for thirteen years connected with the Los Angeles and San Francisco organizations, being sales manager of the former. More recently he has been on the staff of the Society for Electrical Development.

W. P. Hoagland has been appointed central district manager in charge of the Chicago and Minneapolis branch houses. For the past three years Mr. Hoagland has been sales manager at Chicago.

J. H. Gleason takes the position of Chicago sales manager. Mr. Gleason has been power-apparatus sales manager at Chicago.

H. L. Grant, who for the past three years has been general appliance sales manager, located at New York, has been appointed Erie district manager, a new grouping of the distributing houses at Cleveland, Pittsburgh, Detroit and Cincinnati. Mr. Grant's headquarters will be at Cleveland. A. M. Collins continues as manager of the Cleveland house.

It is interesting to note that all of these organization changes are in the nature of promotions. This is in line with the Western Electric Company's consistent policy of advancing men who have made good in their previous capacities.

The Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., has increased its capital stock from $300,000 to $400,000.

The Colonial Electrical Division of the National Lamp Works has opened a branch office at 9 South Clinton Street which is in charge of Charles A. Nash, former president and general manager of the Nash-Odell Company.

The Perfection Specialties Company, Elkhart Lake, Wis., has been organized by George C. Trotter, E. C. Trotter and William K. Burk, to manufacture radio condensers and other apparatus and devices for wireless communication. This company will operate in part of the plant of the Lake Laboratories Company, the original enterprise of George C. Trotter, which manufactures electric phonograph motors. Some additional tool-room and floor equipment is being purchased for this company.

The Federal Lighting Fixture Manufacturing Corporation, 35 North Ninth Street, Philadelphia, has leased two floors in the building at 33 North Eleventh Street in order to increase its floor space.

The Combustion Engineering Corporation, 43 Broad Street, New York City, announces the acquisition of the Quinn Oil Burner & Torch Company. W. R. Quinn, former president of the Quinn Oil Burner & Torch Company, is now associated with the Combustion Engineering Corporation as its manager of the fuel-oil department.

The Galvin Electric Manufacturing Company, manufacturers of electric motors and apparatus, announced on Jan. 1 its removal to new and larger quarters at 3314 South Broadway, St. Louis.

The Gibraltar Battery Manufacturing Company, Tenth and Lancaster Avenues, Dallas, Tex., has been incorporated to manufacture electric storage batteries and equipment and is in the market for equipment, including small motors and a large potential charging outfit. The company is in the manufacturing end only and will sell to dealers. A. Swanson is president of the company.

The Wissler Instrument Company, 601 North Broadway, St. Louis, manufacturer of engineering instruments, has acquired a four-story building, 65 ft. x 100 ft., at 15 Pine Street, for a new plant. A. Wissler is president of the company.

The Watkins Manufacturing Company, Wichita, Kan., manufacturer of wireless equipment, has plans for a two-story factory, 50 ft. x 140 ft., at 208 North Waco Street, to cost about $50,000.

The Uehling Instrument Company, Paterson, N. J., has appointed the Mine & Smelter Supply Company, El Paso, Tex. as its exclusive representative for CO_2 recording equipment and other power plant recording instruments in Arizona, New Mexico and west Texas, as well as in the Republic of Mexico north of Mexico City.

Foreign Trade Notes

PERUVIAN WATER-POWER CONCESSIONS.—The transfer of water rights or water-power concessions in Peru, according to *Commerce Reports*, must obtain approval within sixty days of the Bureau of Waters and Irrigation. Otherwise the transfer will not be recognized or registered.

CHANGES MADE IN SPANISH WATER-POWER LAW.—Certain changes have been made in the hydro-electric law of Spain, *Commerce Reports* states, by a decree of Nov. 10, 1922. The duration of concessions in general shall be seventy-five instead of sixty-five years, counting from the date of the partial or total exploitation of the concession, with exceptions in certain instances. For such exceptions the period of franchise will be ninety-nine years. Upon the expiration of a franchise the whole property will revert without cost or lien of any kind to the state and will become public property. Special exceptions as regards reversion of properties to the state are made in the case of projects of less than 200 hp. used by private industry.

THE YBBS (AUSTRIA) HYDRO-ELECTRIC PROJECT TO BE FINANCED BY TAX.—A municipal tax of 1½ per cent on gas consumption and 4 per cent on electric light, *Commerce Reports* states, was announced recently in the Austrian papers for the purpose of financing the electrification on the Ybbs, undertaken by the commune of Vienna. This tax is expected to yield approximately 1,750,000 crowns a month and to equal the sum expended on the Ybbs project monthly for wages and material.

PROPOSED ELECTRIC RAILWAY FOR JAPAN.—Plans are under way by the Toho Electric Power Company, according to *Commerce Reports*, to organize a subsidiary company, to be known as the Sangu Electric Railway, which will be supplied with hydro-electric power generated in the vicinity of Yokkaichi. The proposed railway is to furnish more adequate transporation between Nagoya and Uji-Yamada and to the grand shrines of Ise at the latter place.

CONCESSION ASKED FOR HYDRO-ELECTRIC PLANT IN ARGENTINA.—Application has been made to the provincial government, *Commerce Reports* states, by Segundo Calderon for a concession covering the construction of a hydro-electric plant to supply electricity in the city of Rio Cuarto, Argentina, and surrounding territory.

ELECTRIFICATION OF THE HORSE-CAR LINE IN MONTEVIDEO PROPOSED.—A bill authorizing the executive to issue mortgage bonds to the amount of 3,500,000 pesos for the electrification of the northern tramway (the government-owned horse-car line) in Montevideo, according to *Commerce Reports*, has been favorably reported upon by the committee of the chamber to which it was referred. Before it becomes a law the bill must come up for a vote in the Chamber.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Denmark (No. 5,004) for complete radio sets and parts thereof.

An agency is desired in Norway (No. 5,017) for electric wiring devices such as switches and sockets, all kinds of marine fittings, all kinds of unmounted knife switches, and wireless telephone apparatus.

An agency is desired in Italy (No. 5,026) for electric bulbs and electric irons.

An agency is desired in Switzerland (No. 5,045) for electric conveying trucks for factories.

An agency is desired in Poland (No. 5,058) for alternating-current motors, three-phase, 50-cycle, 120/210 volts and 220/380 volts; direct-current motors, 110/220 volts; installation material, electrical apparatus, ammeters, voltmeters, wattmeters, etc.

DEMAND IN BOLIVIA FOR ELECTRIC HEATERS.—There is a good demand in Bolivia, *Commerce Reports* states, for electric heating apparatus, especially among the foreign colony in La Paz.

TRANSFORMERS FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by State Electricity Commission of Victoria, Melbourne, Australia, until March 31 for transformers for the Morwell power scheme, specification (No. 23/8.)

ELECTRIFICATION OF THE TRANS-PYRENEAN (SPAIN) RAILWAY.—The Ministro de Fomento has been authorized to call for tenders for equipping (for electrical operation) the Ripoll-Puigcerda Railway, which extends across the Pyrenees. Particulars may be obtained from Señor Ingeniero Jefe de la Segunda Division de Ferrocarriles, Calle de Balmes, Barcelona, Spain.

New Apparatus and Publications

MOTOR FOR TYPESETTING MACHINE.—An offset motor for use with typesetting machines has been brought out by the Cushman Electric Company, Concord, N. H.

TOOL BAG.—A tool bag for electricians, contractors, linemen and others engaged in the electrical industry has been brought out by A. Bruns & Sons, 50 Ralph Avenue, Brooklyn, N. Y.

INSULATED-WIRE STRIPPER.—A device for stripping the insulation from ends of wire and cord has been developed by Wallace G. Grossman, 79 Walker Street, New York City.

ELECTRIC COOKER.—The Excel Electric Company, Muncie, Ind., has developed an electric cooker which operates on 110 volts and 660 watts.

HEADLIGHT FOR MINE SERVICE.—A locomotive incandescent headlight for mine service has been developed by the Jeffrey Manufacturing Company, Columbus, Ohio.

SHADOW SHIELD.—A shadow shield for indirect and semi-direct lighting units has been developed by the Macbeth-Evans Glass Company, Pittsburgh, Pa.

RECORDING INSTRUMENTS.—The Uehling Instrument Company, Paterson, N. J., is distributing a twelve-page folder in which it describes the "Uehling" combined barometer and vacuum recorder for low-pressure turbine and condensing plants.

WELDING AND CUTTING EQUIPMENT.—The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, is distributing a new catalog covering the "Milburn" line of welding and cutting equipment.

ELECTRIC MOTOR.—Bulletin No. 406 issued by the Louis Allis Company, Milwaukee, describes the "L-A" type H. D. (heavy-duty) motor.

RADIO RECEIVING SET.—The Machen Radio Manufacturing Company, 4639 East Thompson Street, Philadelphia, has brought out a new radio receiving set, known as "Machen Clearad," designed to operate on radio-frequency lines.

RECEPTACLES.—A new line of standard receptacles, made single and duplex, known as the "Gilto" type, has been developed by the Machen Electric Manufacturing Company, 4639 East Thompson Street, Philadelphia. These receptacles are also in its "No-lus-Plug" type.

STEAM TURBINES.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing two leaflets, one describing and illustrating the "De Laval" equipment in the Crown Willamette paper mill at West Linn, Ore., and the other the "De Laval" equipment for the Marquette Cement Manufacturing Company, La Salle, Ill.

New Incorporations

THE BERTRAM (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $9,000 by P. M. Rodgers, R. J. Bostic and M. B. Rodgers.

THE TEXAS ELECTRIC & ICE COMPANY, San Antonio, Tex., has been chartered by R. W. Morrison, A. C. Prucha and H. C. Loehr. The company is capitalized at $90,000.

THE ST. ALBANS (W. VA.) ELECTRIC & LIGHT COMPANY has been incorporated with a capital stock of $100,000. The incorporators are J. E. Campbell, W. G. Matthews and G. F. Skidmore.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WESTBROOK, ME.—The Public Utilities Commission has granted the Mallison Power Company permission to issue $125,000 in bonds. Of the proceeds $45,000 will be used in connection with the construction of a new power station at Mallison. The cost of new construction work contemplated is estimated at between $80,000 and $85,000.

SUNAPEE, N. H.—The Lake Sunapee Power Company has prepared plans for the construction of its proposed power plant at Sunapee Harbor, to cost about $300,000.

WORCESTER, MASS.—The installation of an ornamental lighting system on Southbridge Street from Washburn to Cambridge Street is under consideration.

NORVICH, CONN.—The Uncas Paperboard Company, recently organized with a capital of $1,500,000, to operate at the former mill of the Ironsides Board Corporation, contemplates the installation of electric power equipment in connection with extensions and improvements.

Middle Atlantic States

ALBANY, N. Y.—Steps have been taken by a committee of property owners for a new lighting system on the Albany-Troy road. A. E. Leu, Albany, is chairman of the committee.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates the erection of an electric transmission line from here to Sayre, Pa., to cost about $225,000.

JAMESTOWN, N. Y.—The Jamestown Chair Company will build a one-story power house, 25 ft. x 75 ft., at its local plant.

NEW YORK, N. Y.—Bids will be received by the board of purchase of the city of New York, Room 526, Municipal Building, until Jan. 23 for furnishing incandescent lamps to the Department of Water Supply, Gas and Electricity. Grover A. Whalen is chairman of commission.

NEW YORK, N. Y.—The Fulton Ice Company, 18 East Forty-first Street, will install electric power equipment at its proposed ice-manufacturing plant at 138-40 Cherry Street, to cost about $100,000. Ophuls & Hill, 112 West Forty-second Street, are engineers.

OWEGO, N. Y.—The Owego Light & Power Company has contracted with the Binghamton Light, Heat & Power Company, Binghamton, for electricity from the Binghamton plant for a period of ten years. The Binghamton company has also made arrangements with the Binghamton Railway Company for an exchange of power, and transmission lines will be built for this purpose.

SYRACUSE, N. Y.—The erection of a hospital building, power house and laundry building on Prospect Avenue for the St. Joseph's Hospital, to cost about $500,000, is under consideration.

THIELLS, N. Y.—Bids will be received by Mortimer B. Patterson, president of board of managers of Letchworth Village, 7 Wall Street, New York City, until Feb. 1, for construction, including heating, sanitary and electrical work, of attendants' home, assembly hall and industrial building (girls' group) at Letchworth Village, Thiells. L. F. Pilcher, Capitol, Albany, is state architect.

NEWARK, N. J.—Bids will be received by Charles P. Gillen, Director of Parks and Public Property, City Hall, until Jan. 24, for electric and mechanical equipment for the new Center Market, as follows: (a) Electric generating plant; (b) boiler plant and steam piping; (c) market equipment; (d) refrigerating plant; (e) elevator equipment; (f) ventilating apparatus. George B. Hopper and Frank Grad, 116 Market Street, are associated architects.

TRENTON JUNCTION, N. J.—Bids will be received by the board of trustees, New Jersey School for the Deaf, until Jan. 31, for the construction of a transformer house

at the institution and the installation of electrical work in the entire group of buildings now in course of construction. Arnold H. Moses, Temple Building, 415 Market Street, Camden, is architect in charge.

WASHINGTON, N. J.—The New Jersey Power & Light Company has acquired the system of the Washington Electric Company and will extend its transmission lines for local service. The plant will be remodeled for a transformer station and extensions made to the local distributing system.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company is planning to erect a 66,000-volt tower transmission line from Milton to Lockhaven. Electricity will be supplied to cities and towns along the line.

BLOSSBURG, PA. — Gannett, Seeley & Fleming, Inc., engineers, 204 Locust Street, Harrisburg, have organized the Northern Power Company with a capital stock of $500,000, to take over and merge the Blossburg Electric Light & Power Company and sixteen other electric companies operating in this district. The new company will construct a generating plant near Blossburg, to cost about $150,000.

EASTON, PA.—Plans are being prepared by Lockwood, Greene & Company, engineers, 101 Park Avenue, New York City, for a four-story, 80-ft. by 100-ft. factory and a 250-hp. power plant for the Binnery & Smith Company.

EBENSBURG, PA. — The Penn Central Light & Power Company, Altoona, contemplates extensions and improvements to the system of the Ebensburg Light & Power Company, recently acquired.

INDIANA, PA. — The Pine Township Power Company and the Green Township Power Company are being organized to build and operate transmission systems in Pine and Green Townships. James Collins Jones, Bullitt Building, Philadelphia, represents the companies.

JOHNSTOWN, PA. — The Penn Public Service Corporation is planning to erect a number of transmission lines.

JOHNSTOWN, PA. — The Penn Public Service Corporation has acquired the systems of the Warren, DuBois and Jefferson Electric Light & Power companies, operating in Warren, Jefferson, Clearfield and Indiana Counties. The properties will be merged and extended, including the construction of additional substations. The Penn company contemplates the construction of a hydro-electric plant on the Youghiogheny River.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 30, for electric storage batteries for the local naval aircraft factory, in lots of 6, 25, 50, 100 and 200. (Schedule 421.)

PHILADELPHIA, PA.—The Philadelphia & Reading Coal & Iron Company, Reading Terminal, is planning to build a series of steam-driven electric power plants for its coal-mining properties and shops at Pottsville, to replace the present steam and compressed-air service. The plans call for the erection of at least five power stations and the merging of the existing power plants at Good Springs and Locust Point with the system. C. B. Hadesty is general manager.

READING, PA.—The Metropolitan Edison Company will increase the capacity of its power plant at West Reading from 33,000 kw. to 70,000 kw. Plans are also being prepared for the installation of hydro-electric equipment at the station of the York Haven (Pa.) Water & Power Company, recently acquired. New transmission lines will be built.

READING, PA.—The Reading Coal & Iron Company plans to equip all its mining properties in Northumberland and Schuylkill Counties with electrically operated machinery. The project will include the construction of five or six plants, to cost about $500,000.

WILLIAMSPORT, PA.—Extensions and improvements, it is said, will be made to the plant of the Lycoming Edison Company, to cost about $500,000.

SHELBYVILLE, DEL. — The Delaware Light & Ice Company contemplates rebuilding its local electric light and ice-manufacturing plant, recently destroyed by fire, with loss of about $75,000.

BALTIMORE, MD.—The Baltimore Ice Manufacturing Company, Lewis and Lexington Streets, will install electric power equipment at its proposed ice-manufacturing plant, to cost about $125,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company contemplates placing its wires underground on the Falls Road, from the old to the new city line. Underground conduits will be laid from the city line to the power house in Mount Washington.

BALTIMORE, MD.—A power house will be built in connection with a new ward building at the Baltimore Children's Hospital, Forty-first Street and Green Spring Avenue. William G. Beecher and Smith & May, Calvert Building, are associated architects.

CLAREMONT, VA.—The H. J. Arrington Company contemplates purchasing a complete electric light and power plant for commercial service in a small community.

WASHINGTON, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department until Jan. 23 for electric wire and cable for eastern navy yards (Schedule 416).

North Central States

BATTLE CREEK, MICH.—Bids will be received by the director United States Veterans' Bureau, office of the Quartermaster General, 2306 Munitions Building, Washington, D. C., until Feb. 16 for construction of a 500-bed Neuro-Psychiatric Hospital to be erected at Camp Custer, Battle Creek. The work will include the construction of about thirty buildings complete with sewer, water, heating and lighting systems, etc.

DETROIT, MICH. — The Detroit Edison Company has issued $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements. Plans are being prepared for an addition to the substation at Milan, to cost about $25,000.

NORTH FORUM, MICH. — The State Prison Board, Jackson, contemplates the installation of a power house in connection with a new state prison here, to cost about $3,000,000. Smith, Hinchman & Grylls, Marquette Building, Detroit, are architects.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Jan. 26 for station transformers.

CLEVELAND, OHIO.—Bids will be received at the commissioner of purchases and supplies, City Hall, until Jan. 26 for furnishing coal and ash handling equipment, radial brick chimney, feed-water-heater shells and equipment for treating boiler make-up water for the Fairmount pumping station, division of water.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has been granted permission to construct an addition to its steam-operated electric generating plant on West Tenth Street, including new transmission and distributing lines, substations, etc., to cost eventually about $6,000,000.

CHICAGO, ILL. — The Commonwealth Edison Company is preparing plans for a 320,000-kw. power plant at Crawford Avenue and Thirty-fifth Street, to cost about $5,000,000. Graham, Anderson, Probst & White, 80 East Jackson Boulevard, are architects.

SHELBYVILLE, ILL. — Bids will be received by the City Council until Feb. 5 for the installation of a municipal electric light and power plant. Plans and specifications may be obtained from the W. A. Fuller Company, Railway Exchange Building, St. Louis.

BEAR CREEK, WIS.—Electricity will be supplied in Bear Creek to farmers along the Bear Creek Road and in the towns of Maple Creek, Lebanon, Deer Creek and a portion of Black by the Star Electric Heat & Power Company, recently organized as a subsidiary of the Wisconsin Traction, Light, Heat & Power Company. Power to operate the system will be purchased from the Wisconsin Traction, Light, Heat & Power Company, Appleton. W. R. Cornwell, New London, will be manager of the new company.

DELAVAN, WIS.—The Southern Wisconsin Electric Company is planning to change its local system from three-wire, three-phase, 2,300 volts, to four wire, three-phase, 2,300 volts. The cost is estimated at about $12,000.

GRANTSBURG, WIS. — The Burnett County Light & Power Company has petitioned the Railroad Commission for authority to issue $20,000 in notes, the proceeds to be used for extensions to its plant and system during the coming year.

LANCASTER, WIS. — The Interstate Power Company will soon begin work on the reconstruction of its transmission line from Postville to Waukon. The voltage will be changed from 13,200 to 33,000.

MANITOWOC, WIS. — Plans are under consideration by the Public Utilities Commission for extensions to the municipal electric lighting and waterworks systems. The installation of a new generator and automatic stokers, etc., at the electric plant is contemplated.

STURGEON BAY, WIS.—The installation of an ornamental lighting system on Cedar Street in the business district, to cost about $9,000, has been approved by the City Council.

ST. PAUL, MINN.—The Ford Motor Company, Highland Park, Mich., has applied to the Federal Power Commission for permission to build a hydro-electric power plant on the Mississippi River, to be used in connection with a proposed assembling works to cost about $2,500,000. In the event of refusal a steam-driven generating plant will be built.

BRANSON, MO. — The Empire District Electric Company, Joplin, has completed plans for the initial unit of its proposed local hydro-electric power plant, to cost about $2,500,000. The entire project will involve an expenditure of about $10,000,000.

OSCEOLA, MO.—Plans are being prepared by Arthur L. Mullergren, Gates Building, Kansas City, consulting engineer, for the construction of a hydro-electric plant in Osceola, to cost about $450,000. It will be operated by a company now being organized by E. E. Peake, Kansas City.

CHESTER, NEB.—Plans are being prepared for the installation of an electric distributing system in Chester. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

Southern States

MORGANTON, N. C. — The Drexel (N. C.) Furniture Company will install a power house in connection with its proposed local factory, to consist of four two-story buildings, 75 ft. x 250 ft. each.

RALEIGH, N. C.—The Carolina Power & Light Company contemplates the erection of a 60,000-volt substation near the State Hospital in Raleigh.

TUXEDO, N. C. — The Manufacturers' Power Company is preparing plans for the construction of a local hydro-electric plant, with ultimate capacity of 70,000 hp., to cost about $4,000,000.

VANCEBORO, N. C. — Contract, it is understood, has been placed for the installation of a municipal electric light plant.

WILMINGTON, N. C. — The Tidewater Power Company contemplates erecting a transmission line from Wilmington to Warsaw, and from Warsaw to Clinton to supply electricity in those towns and intermediate points. The Tidewater company will sell power in bulk only, and it is expected that companies will be organized in each town to distribute electricity locally. C. W. Petty of Clinton has entered into a contract with the company for energy to be distributed in that town.

ATLANTA, GA.—The Georgia Railway & Power Company is arranging an expenditure of $6,500,000 for extensions and improvements in 1923, to include a 22,000-kw. hydro-electric plant at Tallulah Lake, to cost $1,000,000; completion of the power plant at Tugalo; transmission line from Atlanta to Tallulah, Commerce, Winde and Norcros, to cost $750,000; substations and line extensions at Atlanta, to cost about $500,000, and extensions and improvements to the traction system and gas plants to cost $2,500,000.

BONIFAY, FLA. — The Council has awarded a contract to the Houston Power Company, Dothan, Ala., to supply electricity for lamps and motors in Bonifay. The service will be supplied from the plant at Newton, Ala.

KNOXVILLE, TENN. — The Tennessee Lumber Manufacturing Company will build a power house at its proposed local plant.

CARSON, LA.—The Delta Land & Timber Company will install a substation in connection with the rebuilding of its local plant, recently destroyed by fire, causing a loss of about $150,000.

HOUMA, LA.—The contract for the construction of a municipal electric plant, waterworks system and filtration plant has been awarded to the Merkel Machinery & Contracting Company, Kansas City, Mo. The cost is estimated at $250,000.

MONROE, LA. — The Southern Carbon Company will build power houses at its proposed plants at Swartz, Spyker and Fowler, La., to cost about $1,500,000.

MONROE, LA.—The Bell Manufacturing Company contemplates the installation of a power house in connection with extensions to its plant.

ARDMORE, OKLA. — The Consumers' Light & Power Company will soon take bids for a power plant, to cost about $100,000. The W. A. Baehr Corporation, People's Gas Building, Chicago, Ill., is consulting engineer.

PAUL'S VALLEY, OKLA.—Bonds to the amount of $53,000 have been voted for the installation of a municipal electric plant. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CUERO, TEX. — The City Council has granted the Texas Central Power Company permission to erect a new transmission line from its power plant on the Guadalupe River to Cuero.

FORT WORTH, TEX. — Bonds to the amount of $250,000 have been voted for extensions to the municipal electric light and power system.

PORT ARTHUR, TEX.—The Board of Education plans to build a two-story power house in connection with extensions to the local high school.

SAN ANTONIO, TEX. — The tentative budget of the San Antonio Public Service Company provides for extensions and improvements to the electric power plant and street-railway system, to cost about $1,000,000.

Pacific and Mountain States

KETTLE FALLS, WASH. — Plans are being prepared by the White Pine Sash Company, Spokane, for the erection of a band sawmill, including power plant, dam, logging road, etc., at Kettle Falls, to cost about $150,000. F. W. Horstkotte, Mohawk Building, Spokane, is engineer.

PASCO, WASH.—The Pacific Power & Light Company contemplates extensions and improvements in this section, including additional transmission lines, to cost about $450,000.

PULLMAN, WASH. — The Washington Water Power Company plans to erect a 60,000-volt transmission line to Moscow, Idaho, 11 miles, to replace the 22,500-volt line.

ASTORIA, ORE.—Plans have been prepared by the Hammond Lumber Company for the erection of a new lumber mill, box factory and power house, to replace its plant recently destroyed by fire. The loss is estimated at about $700,000.

ANDERSON, CAL.—The Pacific Gas & Electric Company is planning to remodel the local street-lighting system.

BANNING, CAL. — The San Gorgonia Power Company has been granted permission by the State Railroad Commission to construct two hydro-electric plants near Banning and also authority to issue $400,000 in bonds and $100,000 in capital stock.

LOS ANGELES, CAL. — The Southern California Edison Company has received permission to issue $1,761,000 in bonds, the proceeds to be used for extensions to its system.

OAKDALE, CAL. — The Oakdale and South San Joaquin irrigation districts are arranging a bond issue of $3,750,000, of which $1,516,000 will be used for the construction of a power plant for joint service.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company contemplates building a machine shop, meter shops, transformer shop, warehouse and other miscellaneous structures.

SANTA BARBARA, CAL.—Plans have been approved for the installation of a street-lighting system on Anacapa and Pedregosa Streets, Riviera district.

SCALES, CAL.—Plans are under consideration by Peer & Berkey for the construction of an irrigation project, including hydro-electric plants to develop 36,000 hp., using impulse wheels directly connected to generators. The project includes two diversion dams, several storage dams, steel-pipe line, canals, etc. J. P. Sweeney, Nevada Bank Building, San Francisco, is representative.

SELMA, CAL.—The installation of an ornamental lighting system in the business district is under consideration.

SYLMAR, CAL.—The construction of a power house at the Olive View Sanitarium is under consideration by the Board of Supervisors, Los Angeles.

Canada

BARNET, B. C.—The erection of a high-tension transmission line crossing over Burrard Inlet to Barnet, to cost about $90,000, is under consideration by the British Columbia Electric Railway Company, Vancouver.

AMHERST, N. S.—The Nova Scotia Electric Commission is considering a hydro-electric development near Amherst, where it is estimated that about 600,000 hp. can be developed.

BROCKVILLE, ONT.—The Town Council has passed a bylaw authorizing an appropriation of $57,645 for improvements to the Hydro-Electric system.

DUNDAS, ONT. — The Hydro-Electric Power Commission of Ontario is planning to rebuild its local substation and transformer station, recently destroyed by fire, to cost about $125,000. F. A. Gaby, Toronto, is chief engineer.

GALT, ONT.—The ratepayers have authorized an issue of $125,000 in debentures for extensions to the Hydro-Electric system.

MEAFORD, ONT.—The ratepayers have approved a bylaw providing for an extension to the Hydro-Electric transmission line. The bylaw for the purchase of the plant of the Georgian Bay Milling & Power Company was defeated.

OTTAWA, ONT.—The ratepayers have approved a bylaw to purchase the street railway owned by the Ottawa Electric Company. Extensions are contemplated, including the construction of 17 miles of single track, the erection of car barns and the purchase of forty-seven new cars, to cost about $1,500,000.

TORONTO, ONT.—The Toronto Hydro-Electric Power Commission of Ontario has decided to carry out plans at once for the complete conjunction of the former Toronto-Niagara system with the Hydro-Electric system.

TORONTO, ONT.—Plans are being considered for equipping the Grand Trunk Railway from Toronto to Hamilton and from Hamilton to Niagara Falls, for electrical operation, also for laying additional tracks for fast radial service, a total distance of 80 miles. A. F. Stewart, 407 Old Union Station, is chief engineer of the Canadian National Railways.

MONTREAL, QUE.—Interests connected with the Shawinigan Water & Power Company have organized the St. Maurice Power Company to operate as a subsidiary in connection with utilizing the Big Gres Falls on the St. Maurice River for development of hydro-electric power. The company will be capitalized at $8,000,000 and will authorize an issue of $12,000,000 in bonds.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 26, 1922)

1,440,225. EMERY WHEEL STAND; J. J. Koukol, Cuba, Kan. App. filed April 6, 1921. One or more stones can be attached and operated on same piece simultaneously.

1,440,305. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed Jan. 9, 1920. Resistance elements represent clusters of logs.

1,440,325. SAFETY RAZOR; R. H. Wilhelm, Chicago, Ill. App. filed Aug. 9, 1921. Flashlight placed in handle.

1,440,354. BATTERY PLATE; J. J. Hanna, Ordway, Col. App. filed April 8, 1922. Allows for expansion and contraction of plates.

(Issued Jan. 2, 1923)

1,440,365. TELEPHONE SYSTEM; R. W. Augustine, Chicago, Ill. App. filed July 31, 1916. Code-ringing system for different stations upon poly-station line.

1,440,389. JUNCTION BOX FOR CONDUIT PIPING; J. W. Jones, Perth, Scotland. App. filed March 3, 1923.

1,440,402. ELECTRIC HEATER; H. Meredith-Jones, New York, N. Y. App. filed Dec. 14, 1921. Room heater provided with racks for drying clothes.

1,440,407. DETECTING CIRCUITS; H. S. Osborne, New York, N. Y. App. filed July 2, 1920. Carrier-current receiving apparatus.

1,440,419. TROLLEY-WIRE GUARD; D. Stitt, Morgantown, W. Va. App. filed May 19, 1922. Guard normally extending below the trolley wire automatically swung out by passage of trolley wheel.

1,440,432. WIRELESS RECEIVING SYSTEM; C. T. Allcutt, Pittsburgh, Pa. App. filed June 25, 1921. Receiving system for undamped signal impulses.

1,440,470. METHOD AND APPARATUS FOR TESTING WELDS; I. F. Kinnard, Wilkinsburg, Pa. App. filed April 21, 1921. By comparing resistance and reluctance of weld with unwelded part.

1,440,490. REGENERATION OF ALTERNATING-CURRENT COMMUTATION MOTORS; L. M. Perkins, Wilkinsburg, Pa. App. filed Jan. 25, 1919. Manual control of phase relation of exciting voltage regulates regenerative torque.

1,440,502. METHOD OF AND APPARATUS FOR MAKING FINE METALLIC POWDERS AND COLLOID SOLUTIONS; J. Slepian, Wilkinsburg, Pa. App. filed Jan. 8, 1920. Electrolytic process.

1,440,511. SECTION BREAK DEVICE; N. J. A. Wahlberg, Pittsburgh, Pa. App. filed Nov. 11, 1919. Section switch for mine trolley.

1,440,515. MELTING FURNACE; H. G. Wellman and C. D. Gilpin, Cleveland, Ohio. App. filed May 17, 1920. Adopted to melt non-ferrous metals for making bronze, brass and similar castings.

1,140,519. ELECTRIC BAKE OVEN; J. C. Woodson, Mansfield, Ohio. App. filed June 3, 1921. Means for equalizing heating effects at both ends of oven.

1,440,551. ELECTRIC POWER PLANT; H. R. Patterson, Toledo, Ohio. App. filed Sept. 10, 1919. Engine-driven storage-battery set.

1,440,651. ATTACHMENT PLUG; R. B. Wolcott, Cleveland Heights, Ohio. App. filed Dec. 23, 1916. Swivel plugs.

1,440,678. METHOD OF PLATING WOODEN ARTICES; F. Hachmann, St. Louis, Mo. App. filed Dec. 31, 1920. Electrolytic process.

1,440,693. ELECTRICAL WATER HEATER; H. R. Montgomery, Dayton, Ohio. App. filed Jan. 7, 1921. Automatic pipe-line heater.

1,440,711. ARC-WELDING APPARATUS; P. P. Alexander, Lynn, Mass. App. filed July 26, 1921. Automatic or semi-automatic type in which metallic electrode is automatically fed to work.

1,440,724. ELECTRODE FOR ELECTRIC FURNACES AND PROCESS FOR MANUFACTURING THE SAME; C. W. Söderberg, Christiania, Norway. App. filed Sept. 8, 1919. Tamping or pressing an electrode material into metallic mantle.

1,440,729. ELECTRIC STEP-BY-STEP MOTOR OF THE UNWOUND-ARMATURE TYPE; J. W. French, Glasgow, Scotland. App. filed March 30, 1921. Three motor elements, each comprising an electromagnet and an unwound armature.

1,440,750. ELECTRIC RIVET HEATER; E. Schroder, Berlin, Germany. App. filed July 6, 1921. Cooling electrodes by evaporating liquid held in cavity in electrode.

1,440,752. TELEPHONE TEST SET; R. B. Stone, Nashville, Tenn. App. filed Sept. 9, 1919. Hand telephone set for use along railways.

1,440,760. ELECTRICAL COIL; S. R. Wright, Rawdon, near Leeds, England. App. filed Aug. 22, 1921. Method of winding high-voltage coils to prevent initial surges.

1,440,774. ELECTRICAL DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 19, 1921. Adapted to remove water from petroleum emulsions.

1,440,775. DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 19, 1921. For petroleum emulsions operated by electrostatic field.

1,440,776. DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 27, 1921. Upper electrode adjustable.

1,440,778. WATER INDICATOR FOR OIL WELLS; W. L. Foster, Whittier, Cal. App. filed May 21, 1921.

1,440,804. DIRECTION INDICATOR; E. B. Wagner, San José, Cal. App. filed Aug. 6, 1919. Direction indicator for automobiles.

1,440,826. ELECTRICAL HEATING ELEMENT FOR PRESSURE COOKERS; E. G. Hager, Kimberly, Idaho. App. filed July 5, 1921.

1,440,828. DEHYDRATOR; F. W. Harris, Los Angeles, Cal. App. filed Sept. 18, 1919. Process of removing water from petroleum oils.

1,440,834. RADIO COMMUNICATION; C. V. Logwood, Chicago, Ill. App. filed July 2, 1921. Transmitting equipment comprising several vacuum tubes.

1,440,835. PROCESS OF AND APPARATUS FOR DEHYDRATING PETROLEUM EMULSIONS BY OSMOSIS; W. Meredith, Alameda, Cal. App. filed Feb. 14, 1921.

1,440,840. AUTOMOBILE HEADLIGHT; F. A. Reece, Chestnut Hill, Mass. App. filed Sept. 22, 1917. Lamp bulb containing two light centers with an opaque member between them throws all rays downward.

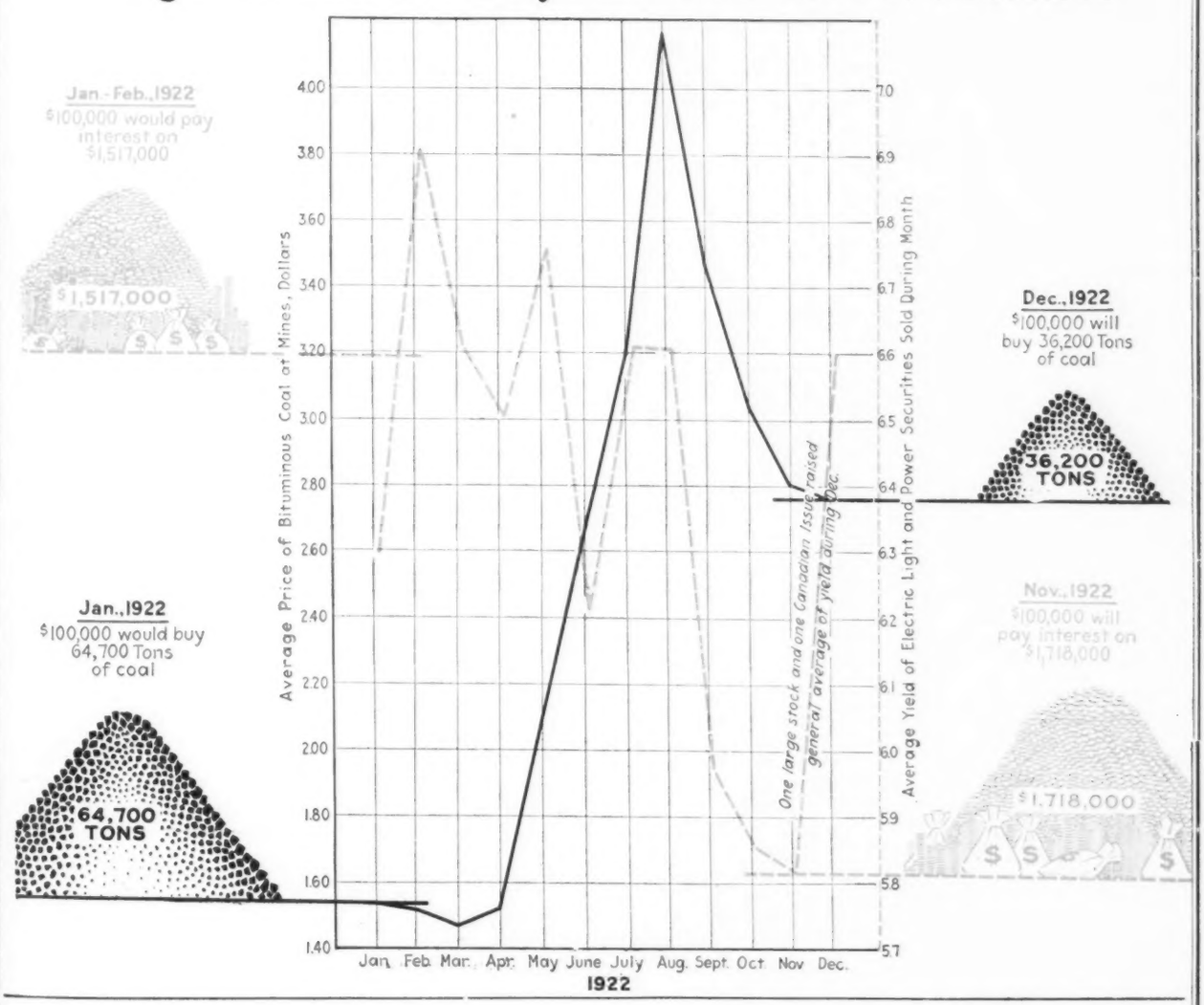
1,440,879. ELECTRIC SYSTEM FOR VEHICLES; T. L. Lee and R. H. Sullivan, Rochester, N. Y. App. filed Jan. 20, 1921. Automatic storage-battery-charging system.

1,440,951. ARMATURE CONSTRUCTION; V. G. Apple, Dayton, Ohio. App. filed April 27, 1918. Insulation and support for armature and commutator.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

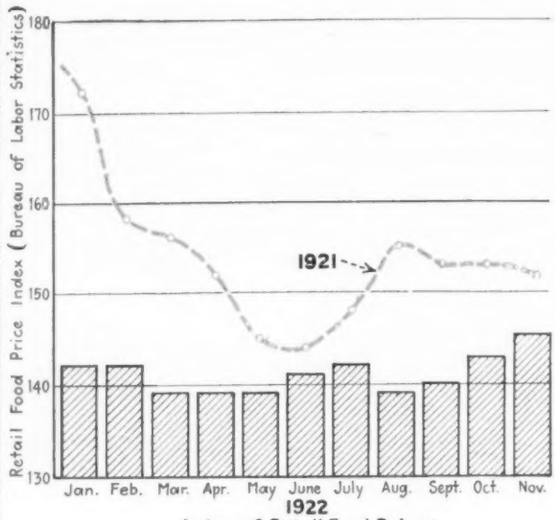
During 1922 Cost of Money Fell While Cost of Fuel Rose



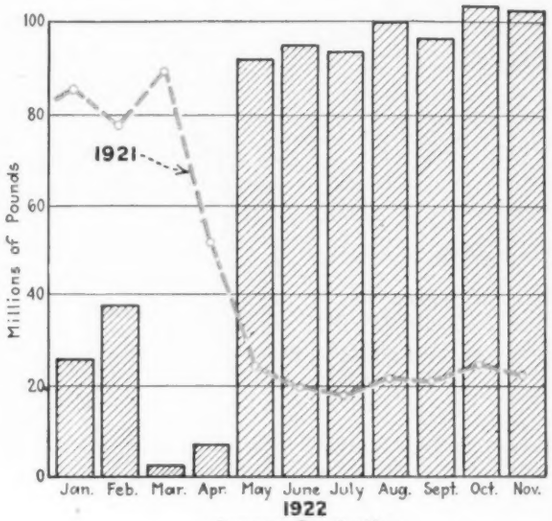
A Year Calling for Extreme Economy and Large Expenditures

NECESSARY extensions to central-station equipment call for hundreds of millions of dollars during 1923. A very large portion of this amount must be borrowed from the public, and interest on the loans must be paid. The year opens with the possibility for efficiently managed companies to borrow at a cost under 6 per cent, which is significant when it is remembered that at the opening of 1922 the average yield demanded was 6.6 per cent and in August, 1920, it was over 8 per cent. This means that the industry will be much better able to meet the largely increased demands for electrical energy by added equipment and that the profits from the new load will not be eaten up through payments of interest.

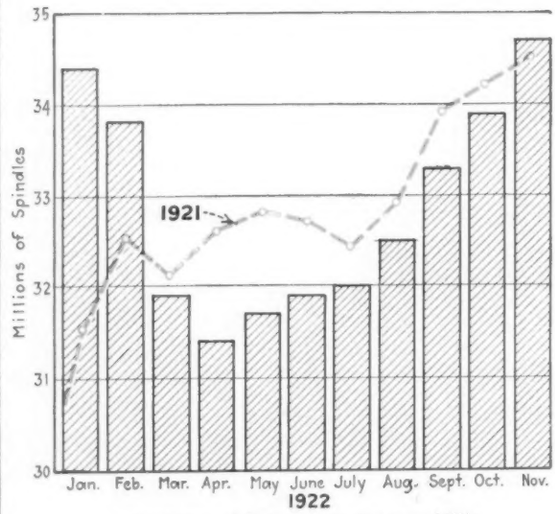
The thorn in the rose is the price of coal. Fuel costs almost twice as much as it did a year ago, and the cost of fuel forms almost 75 per cent of the production expenses of a large generating plant. The encouraging fact is that the cost of coal will undoubtedly decrease as the year advances.



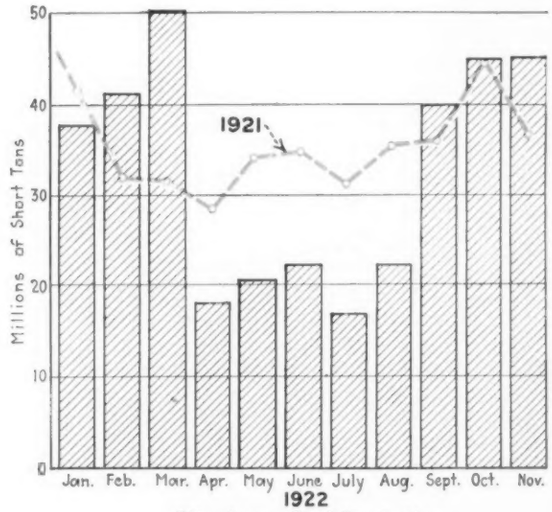
Index of Retail Food Prices



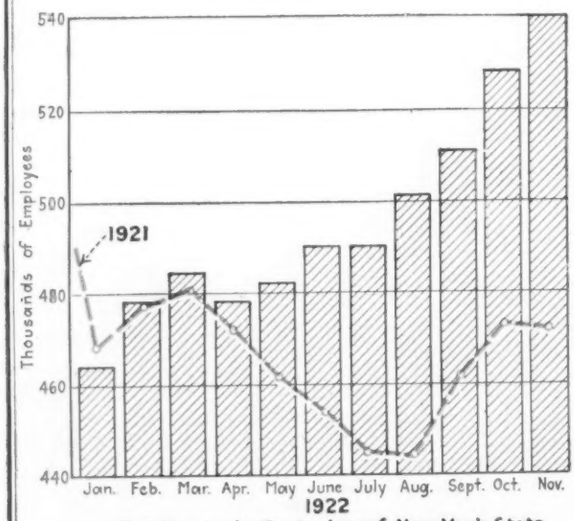
Copper Production



Activity of Spindles in Cotton Mills



Bituminous Coal Production



Employees in Factories of New York State

A Job for Every Workman

THE transition of the country from a period with much lack of employment to one in which few men are looking for work was one of the most remarkable economic changes witnessed during 1922. The low point in employment, as indicated by the employees in the factories of New York State, was during July and August of 1921. Subsequent to that date employment increased by almost uniform steps until by the end of 1922, a period of sixteen months, the number employed was about 20 per cent greater than in August, 1921. In other words, in New York State alone almost 100,000 more men were employed in the factories on Jan. 1, 1923, than at a period sixteen months previous to that date.

Another skyrocket movement during 1922 was in the production of copper. In one month, from April to May, the production of copper jumped over 1,200 per cent, or from 7,026,000 lb. to 92,048,000 lb. The production for the first eleven months of 1922 showed an increase of 36 per cent over a similar period in 1921, but was almost 30 per cent below the 1920 figures. Exports of copper were 29 per cent greater than in 1921 on the basis of ten-month figures.